DOCUMENT RESUME

ED 084 745 EC 060 575

AUTHOR	Silver, Rawley A.; And Others
TITLE	A Study of Cognitive Skills Development Through Art Experiences; An Educational Program for Language and Hearing Impaired and Asphasic Children.
INSTITUTION	New York City Board of Education, Brooklyn, N.Y. Office of Special Education and Pupil Personnel Services.
SPONS AGENCY	New York State Education Dept., Albany. Office of Urban Education.
PUB DATE	73
NOTE	110p.
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	Academic Achievement; Adolescents; *Art; *Aurally Handicapped; Childhood; *Conservation (Concept); *Exceptional Child Research; *Mathematics; Research Projects; Teaching Methods; Test Construction; Test Interpretation

ABSTRACT

Eighteen students, 8 to 15 years of age, from six classes in the School for Language and Hearing Impaired Children in New York City, learned mathematical concepts of conservation, grouping, ordering, and a spatial orientation through procedures developed for teaching and evaluating cognitive achievement of painting and drawing tasks. The students were taught in three 40 minute classes 2 days each week. Classroom teachers participated in weekly inservice workshops. Two teaching procedures (such as locating a doll on a model landscape) were developed for each of the cognitive areas (such as sequential ordering). Nine tests were developed and administered including a pretest and posttest of cognitive skills; a drawing test of ability to select, combine, and represent; an evaluation by an art therapist-painter; and a teacher rating scale. Also, the Torrance Test of Creative Thinking was administered. Performances of the 18 children were summarized. The results indicated that the art procedures were useful in reaching conservation, grouping, ordering, and spatial orientation as well as in evaluating cognitive and visuospatial abilities and disabilities, and that art educators could go beyond art without neglecting development of art skills and values. (Appendixes contain test instruments and detailed results for all students.) (MC)

FILMED FROM BEST AVAILABLE COPY

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

ED 091745

BOARD OF EDUCATION CITY OF NEW YORK

A Study of

COGNITIVE SKILLS DEVELOPMENT THROUGH ART EXPERIENCES

AN EDUCATIONAL PROGRAM FOR LANGUAGE AND HEARING IMPAIRED AND ASPHASIC CHILDREN

prepared by

RAWLEY A. SILVER, ED. D., A.T.R.

SCHOOL FOR LANGUAGE AND HEARING IMPAIRED CHILDREN

DR. JOHN D. HARRINGTON - PRINCIPAL

REIMBURSABLE PROGRAM SPECIAL SCHOOLS - DISTRICT 75

IRWIN SHANES - COORDINATOR

OFFICE OF URBAN EDUCATION

ETTA J. BERNSTOCK, DIRECTOR

Function 17-36413

Project #147232101

State Urban Education

1973

060 515

ED 084745

BOARD OF EDUCATION CITY OF NEW YORK

JOSEPH MONSERRAT, *President*

SEYMOUR P. LACHMAN, *Vice President*

MURRY BERGTRAUM

JAMES F. REGAN

ISAIAH E. ROBINSON

CHANCELLOR

IRVING ANKER

DEPUTY SUPERINTENDENT OF SCHOOLS

SEELIG LESTER

-INSTRUCTIONAL SERVICES-

ASSISTANT SUPERINTENDENT

MURRAY HART

OFFICE OF SPECIAL EDUCATION - SCHOOLS

ASSISTANT SUPERINTENDENT

HELENE M. LLOYD

DIVISION OF FUNDED PROGRAMS

PREFACE

The School for Language and Hearing Impaired Children under the direct supervision of Dr. John D. Harrington, Principal, provides for the education of language impaired children (city-wide) and for the education of the deaf children of Staten Island. Its headquarters are located in a wing of P-158-M and it conducts the following centers:

At P.S. 158-M	23 classes, language-impaired children
At P.S. 16-Q	5 classes, older language-impaired students (14-17)
At P.S. 163-K and P.S. 204-K	17 classes, language-impaired children
At P.S. 63-Q	6 classes, language-impaired children
At P.S. 45-R	2 classes, language-impaired children
At P.S. 40-R	4 classes, language-impaired children

Instruction is highly individualized and specialized. Admission to the class is achieved through the Evaluation and Placement Unit located in each borough.

Approximately 80% of the children participating in the program at the School for Language and Hearing Impaired Children P-158-M are Black or Puerto-Rican children from economically impoverished areas of the city. For many of these children, the handicap they carry can be traced to the rubella epidemic which struck the depressed areas of the city rather heavily.

Language impaired children include three general types: A small percentage indicate organic (but no peripheral) deficit in the ability to receive or "take in" language. A second group includes those whose hearing is grossly normal but whose primary disability is in the expressive area. A third group includes those in which a peripheral hearing deficit is complicated by additional learning, social or environmental factors.

Guidance, psychological, and social work services are provided by a licensed guidance counselor and a Bureau of Child Guidance team. Licensed teachers of speech are assigned by the Bureau of Speech Improvement to do individual speech therapy for those most in need of such instruction. Bus service is provided for these programs.

The school develops and implements its own curriculum materials to meet its special needs. An intensive teacher development program, both in-service and pre-service is conducted, the latter in cooperation with Hunter College of the City University and other major colleges and universities.

Special high school placements are available for capable, language impaired youth of secondary school age.

A Work-Study Program is available for language impaired youth (17-21) who have not achieved employment. Guided and planned work experience is supplemented by instruction in life related spheres and applied life skills.

The highly specialized program is administered and supervised for the New York City Board of Education through the Office of Special Education - Schools, District 75, Murray Hart, Superintendent assisted by Bernard Messenger, Principal Assigned for the Division of Special Schools for the Handicapped.

During the 1972-73 School Year a highly specialized program was provided through State Urban Education funding entitled "Program for Language and Hearing Impaired and Aphasic Children, Function #17-36413."

This program consisted of two components. Component I was designed to develop basic cognitive skills through the use of art. It was felt that basic reading and mathematics concepts such as order, sequence, spatial relationships and conservation of liquids and solids could be developed through art experiences. Component II dealt with the problem of language confusion of children who live in bilingual and multilingual homes.

At the request of Mr. Alby Lutkus - consultant for State Urban Education Programs and Mr. John House, Administrative Director of State Urban Education of the State Education Department, a report of the methodologies, materials and findings of this program has been prepared for dissemination to interested agencies, parent groups and other school districts.

This report concerns itself with Component I, the development of cognitive skills through art experiences for language and hearing impaired children.

TABLE OF CONTENTS

Page

LIST OF FIGURES.....iv

I. INTRODUCTION

Mathematical and Logical Ideas..... 1
Teaching Procedures, a Pilot Study..... 3
Evaluating Procedures..... 3

II. THE PROJECT

Objectives..... 6
Subjects..... 6
Project Activities..... 7

III. TEACHING PROCEDURES

Grouping..... 9
Selecting from an array.....10
Placing Objects in Given Positions.....15

Sequential Ordering.....16
Ordering Colors.....16
Locating Doll on a Model Landscape.....17

Spatial Orientation.....17
Drawing from Observation.....17
Horizontal and Vertical Orientation.....18

IV. EVALUATION PROCEDURES

First Term Pre-Test of Cognitive Skills.....20
First Term Post-test of Cognitive Skills.....20
Drawing Test of Ability to Select,
Combine, and Represent.....21
Drawing Test of Ability to Represent
Spatial Relationship.....21
Evaluation of Art Work by an Art Therapist.....21
Evaluation of Art Work by a Professor of Art.....21
Teacher Rating Scale.....21
Second Term Preppost Test of Cognitive Skill.....22
Additions to Second Term Pre-post Test.....22
Torrance Test of Creative Thinking.....22
Second Teacher Rating Scale.....22

CHAPTER Page

V. RESULTS

Conserving..... 24
Ability to Conserve Liquid..... 24
Ability to Conserve Numbers..... 24
Ability to Conserve Solids..... 25
Horizontal Orientation..... 25
Vertical Orientation..... 26

Grouping
Ability to Group 3 Objects..... 27
Ability to Group 12 Objects..... 27
Ability to Select..... 28
Ability to Combine..... 28
Ability to Represent..... 29
Ability to Select, as Evaluated by Art Ed..... 29
Ability to Combine, Evaluated by Art Ed..... 29

Ordering
Ability to Order a Series of Sticks..... 30
Ability to Order a Matrix..... 30
Ability to Order a Series of Colors..... 30
Ability to Place Objects in Given Positions..... 31
Ability to Represent Spatial Relationships..... 31
Teacher Rating Scale..... 31
Language Development..... 31
Cognitive Ability..... 31
Attitudinal Change..... 32
Math-Reading-Language Attitudes-Motor Skills..... 33
Creative Ability
Torrance Test of Creative Thinking..... 33
As Evaluated by a Professor of Art and Ed..... 33
As Evaluated by Art Therapist-Painter..... 33

Responses of Individual Children..... 34

VI. SUMMARY AND OBSERVATIONS..... 51

REFERENCES..... 58

APPENDIX

Table

I. Instructions for Administering First Term Pre-test of Cognitive Skills. 59
II. Instrument for Scoring First Term Pre-Test. 61
III. Instructions for Administering Additions to First Term Post-test. 62
IV. Instrument for Scoring Post-test. 63
V. Drawing test of Ability to Select, Combine, and Represent. 65

Table

VI. Drawing test of Ability to Represent Spatial Relationships. 66
VII. Instrument for Evaluating Art Work. 67
VIII. Teacher Rating Scale 68
IX. Instructions for Administering Second Term Pre-post Test of Cognitive Skills. 69
X. Instrument for Scoring Second Term Test. 71
XI. Instructions for Administering Additions to Second Term Pre-post Test 73
XII. Instrument for Scoring Additions 75
XIII. Results: Pre-test of Cognitive Skills, Experimental Group 76
XIV. Results: Post-test of Cognitive Skills, Experimental Group 77
XV. Results: Pre-test of Cognitive Skills, Control Group. 78
XVI. Results: Post-test of Cognitive Skills, Control Group. 79
XVII. Results: Additions to Post-test of Cognitive Skills 80
XVIII. Results: Horizontal Orientation. 81
XIX. Results: Vertical Orientation. 82
XX. Results: Pre-test of Ability to Select, Combine, and Represent 83
XXI. Results: Post-test of Ability to Select, Combine, and Represent 84
XXII. Results: Evaluation of Art Work By Professor of Art Education 85
XXIII. Results: Teacher Rating Scale Pre-test, Experimental Group 87
XXIV. Results: TRS Post-test, Experimental Group 88
XXV. Results: TRS Pre-test, Control Group 89
XXVI. Results: TRS Post-test, Control Group. 90
XXVII. Results: Torrance Test of Creative Thinking, Pre-post Experimental Group. 91
XXVIII. Results: Torrance Test Pre-post Control Group. . . 92
XXIX. Results: Evaluation of Art Work by Art Therapist-Painter. 93
XXX. Results: Pre-post Classroom Test of Ability to Represent Spatial Relationships 94
XXXI. Results: Second Teacher Rating Scale 97

LIST OF FIGURES

FIGURE		Page
1.	"Wedding Presents."	11
2.	Examples of model drawings	11
3.	Nurse on crutches	11
4.	"The Babies Sitter"	11
5.	Mother, Father, and Baby	12
6.	Restructured Bride and Nurse	12
7.	"Mouse Bug"	12
8.	Cat and Mice	13
9.	"My Cat in a Garden"	13
10.	Ruth's First Drawing	13
11.	Mixing Color in Sequential Order	13
12.	Fishing on a Lake	14
13.	"Good for You/go to Swimming"	14
14.	"You Forgot the Lifesaver Hi Hi"	14
15.	Horizontal and Vertical Orientation	23
16.	Victor's First Drawing	23
17.	Victor's Mid-term Painting	23
18.	Victor's last Painting	23

CHAPTER I

INTRODUCTION

The purpose of this project was threefold: first, to help an experimental group of children develop certain mathematical and logical ideas; second, to develop procedures for teaching these ideas through drawing and painting; third, to develop procedures for evaluating cognitive achievements through drawing and painting tasks.

The children who participated in the project had hearing and language impairments caused by damage to the brain rather than the ear. This type of impairment does not necessarily cause a decrease in auditory sensitivity. It does, however, cause a decrease in auditory comprehension. A child may be able to hear speech but be unable to understand what is said. This impairment takes two fundamental forms - receptive and expressive. Children with the expressive form have difficulty producing language. Children with the receptive form have difficulty comprehending language. The participants in the project had severe receptive or expressive impairments, often both in varying degrees, and many had peripheral losses of hearing as well.

1. Mathematical and Logical Ideas

There are three basic mathematical ideas, cited by Jean Piaget, from which all the branches of mathematics can be generated. The first form is based on the mathematical idea of a group and applies essentially to classes and numbers. The second form is based on ideas of order and applies to relationships. The third form is based on ideas of space and applies to neighborhoods, or to points of view and frames of reference (Piaget, 1970, p.24).

Although these ideas are ordinarily associated with language, they can also be perceived and interpreted visually; and although they may seem highly abstract, Piaget has found similar ideas in the thinking of unimpaired children as young as 6 or 7 years of age.

Basic in logical thinking is the ability to conserve, to recognize that an object remains the same in spite of transformations in its appearance. Most rational though depends on conservation, according to Piaget, and Jerome Bruner has observed that the ability to recognize equivalence under different guises, is a powerful idea not only in science but in everyday life. Up to the age of about 7, children are typically unable to conserve a quantity of liquid over alterations in its appearance.

What about children with language and hearing impairments? Children who cannot learn language in the usual way are often deficient in cognitive functioning. Their education traditionally centers around language development. It is generally assumed that the cause of their deficiency is language retardation but this may be misleading. Language is obviously related to thinking, but whether it is essential is open to question.

There is considerable evidence in recent scientific literature that language and thought develop independently; that language follows, rather than precedes logical thinking; that language is not the source of logic but to the contrary, is structured by logic; and even though language expands and facilitates thought, high level thinking can and does proceed without it (Piaget, 1970; Sinclair-de-Zwart, Elkind, Furth, Arnheim).

If so, the assumption that improving a child's language will improve his thinking may also be true in reverse. Higher levels of thinking may be the cause as well as the consequence of improved language skills, and non-verbal procedures may cause levels of language to rise.

In the thinking of an unimpaired child, the function of language is primarily to pin down his perception, organize his experiences, and understand and control his environment, according to Strauss and Kephart. By labeling his perceptions with a word, the hearing child can make them usable again and again. In addition, language opens up the whole field of vicarious experiences. When he cannot obtain a desired result, he can substitute words for the unsuccessful activity, and by symbolizing it, obtain it imaginatively without having to lift a finger, so to speak. Furthermore, by hearing about the experiences of other people, he can obtain information that otherwise he would have to obtain by himself. He can compare himself with others, and use the experiences of others, without having to have the experiences himself. (p.91)

In the thinking of a language impaired child, art symbols could conceivably take over some of the functions of language symbols. Studies of brain mechanisms underlying language functions indicate that expressive and receptive disorders are associated with lesions in the left side of the brain. Damage in the left hemisphere tends to affect verbal learning while damage in the right hemisphere tends to affect visuo-spatial abilities. Thus even though a child's capacity for learning language may be severely impaired, his capacity for visuo-spatial thinking may be intact.

These studies also indicate that learned patterns and incoming information are relayed widely throughout the brain. Large areas, called association areas have no direct connections with incoming sensory channels, but serve as integrating centers to which information may be relayed, according to Dr. Richard Masland. He postulates that events occurring in temporal relationship to each other interact, and that later experiences, involving only part of a total pattern, may activate the larger pattern because of previously established interactions He also postulates that every experience results in the establishment of activation patterns (p. 94).

If so, can art experience establish activation patterns for language to follow? Would drawing pictures enable a child to sustain thoughts he cannot verbalize, or associate them with past experiences, or trigger new associations? Can art procedures bypass language disorders and lead a child to the fundamental mathematical or logical ideas?

2. Teaching Procedures, A Pilot Study

In an attempt to find answers to the preceding questions, a pilot study was undertaken at the School for Language and Hearing Impaired Children in New York City, January to May, 1972. Its aim was to teach these children to conserve and classify through art procedures.

Nine children attended experimental art classes and 9 served as controls. The experimental group consisted of half the number of children in three regular classes in the school. Chosen at random, they participated in weekly art classes of 40 minutes for 15 weeks. The control children did not attend art classes, remaining with their classroom teachers to do academic work.

To measure changes in ability, two tests were administered on a pre-post test basis*. In the pre-test for conservation, only 1 of the experimental children and none of the control children demonstrated ability to conserve liquid. In the post-test, however, 5 of the 8 experimental children who initially demonstrated lack of ability, subsequently demonstrated ability to conserve, while none of the control children demonstrated this ability.

In the pre-test of ability to form groups, only 2 of the experimental children and 1 of the controls demonstrated ability to group on the basis of class or function. In the post-test, however, 6 of the 7 experimental children who initially demonstrated lack of ability, subsequently grouped on the basis of class or function, while only 1 of the 8 control children who initially demonstrated lack of ability, subsequently demonstrated this ability.

Since the instructor had administered the tests in the pilot study, the tests were again administered to the experimental children by the examiner of the present project, 8 months after the pilot study ended. She found that the 5 children were still conservers, and that 5 of the 6 still grouped on the basis of class or function.

Teaching procedures in the pilot study had been indirect. Conservation, for example, had been taught with clay and tested with liquid. These and other teaching procedures will be discussed in Chapter III.

3. Evaluating Procedures

Intelligence tests are often unsatisfactory for evaluating the cognitive abilities of children who have difficulty understanding verbal directions or making their replies understood.

To illustrate, an attempt to match children in the second term of the project, involving a painstaking search through the records of 38 children, produced a mass of confusing data. Twelve children had been

*these tests were used again in the present project, Table I, A and C

tested with the WISC scale, receiving IQ scores between 72 and 106. The child who received the highest score, 106, nevertheless received the low score of 66 on the Stanford Binet test. A child scored 77, received a score of 96 for performance and 65 for verbal IQ. Two children could not be scored. The Stanford Binet Test had been used with 6 other children, 3 of whom were scored between 50 and 70, and 3 were unscored. Other tests employed included the Peabody, Leiter, Merrill Palmer, Hiskey, Bender Gestalt, Goodenough, and Arthur Point Scale. Many were unscored for reasons such as, "did not respond" or "verbal communication nil". In addition, some children had multiple disabilities, cerebral palsy a frequent diagnosis.

After reviewing the data, the evaluator decided to use a preliminary tentative match based on sex, age, diagnosis as Expressive and/or Receptive, and class assignment.

Drawing tests have been designed to permit inferences about cognition. The Bender-Gestalt and Goodenough are well-known examples, and art therapy techniques have been published widely. A previous study by the project coordinator-instructor found that art work by deaf and aphasic children provided evidence useful in assessing various abilities, attitudes, interests, and needs (Silver, 1966).

It may be useful to try a different approach to evaluating the cognitive skills of these children, and to start by defining cognition as Bruner has explained it--a way of organizing the barrage of stimuli from the outside world. We reduce its complexity by constructing models, imaginary representations, then predicting what will happen next from the models. We match a few milliseconds of new experience to a stored model, and read the rest from the model. For example, we may glimpse a shape and a snatch of movement, then respond to the model we happen to match--night watchman or burglar.

In other words, thought is carried out by representing reality vicariously and economically. We represent with the aid of "intellectual prosthetic devices", such as language, but there are pictorial devices as well, as Bruner points out, "it is still true that a thousand words scarcely exhausts the richness of a single image" (1966, p. 19).

A child's drawing is a pictorial device that can represent reality vicariously and economically, and thus reflect his thinking. The child with inadequate language is deprived on many opportunities to represent his experiences. Without language, he lacks our major device for constructing models of reality. This alone could account for cognitive deficiency. But if his visuospatial capacities are intact, he could construct visual models of reality, and represent his experiences nonverbally by drawing them.

A representational drawing is not merely an imitation of reality. It is one thing to perceive an object, and quite another to represent it, as Piaget has pointed out. A child can recognize a circle long before he can draw it. In order to represent a circle in a drawing, he must first be able to conjure up a mental image while the circle is out of sight (1967, p.37).

A child's concepts of space begin on the perceptual level and continue

on the representational level; at first, imitative and largely passive, then intellectually active. Piaget and his associates, and Bruner and his associates, have traced the development of cognition in orderly sequential stages. Their observations were based on experiments with unimpaired children who were presented with a variety of tasks.

Some of these tasks seem particularly appropriate for language impaired children, or can be readily adapted. They have been used in the project to evaluate cognitive abilities and the effects of art experience on cognitive skills. Representation also played a major role in the teaching and evaluating procedures developed in the project.

Although aesthetic development was not among the stated objectives of the project, it was of much concern. Some art educators feel that art should not be used for therapeutic purposes, that using art for any purpose other than instruction, undermines art education and interferes with learning in art. On the other hand, some art therapists and psychiatrists take the position that instructing or structuring interferes with spontaneous expression in art.

Since the project was based on the assumption that aesthetic and therapeutic goals do not necessarily conflict, it was concerned with developing art skills and sensitivity to art values. There was another reason for this concern--the general tendency to underestimate the aptitudes of handicapped children. This was indicated in a previous project which found that deaf children and adults were more creative than had been supposed, and showed as much skill and sensitivity as hearing populations (Silver, 1967).

In an attempt to obtain additional information, the project evaluations included the Torrance Test of Creative Thinking and evaluations of art work by an art therapist-painter and an art educator.

CHAPTER II

THE PROJECT

Objectives

The program specified five objectives:

1. At least 40% more student participants in the experimental program (as compared with program controls) who initially demonstrate lack of ability on a pre-test to conserve will, based upon a post-test to be administered upon the conclusion of the program, demonstrate the ability to conserve.

2. At least 40% more student participants in the experimental program (as compared with program controls) who initially demonstrate lack of ability in grouping objects according to class or function will, based upon a post-test to be administered upon conclusion of the program, demonstrate the ability to group objects according to class or function.

3. At least 20% more student participants in the experimental program (as compared with program controls) who initially demonstrate lack of ability on a pre-test to order sequentially will, based upon a post-test to be administered upon conclusion of the program, demonstrate the ability to order sequentially.

4. At least 40% more student participants in the program (as compared with program controls) will demonstrate improvement on a pre-post test basis in combined cognitive activity, attitudinal change, and language development, as measured by a teacher rating scale.

5. The participants will, as compared with the controls, evince a greater percentile gain on a pre-post test basis in the ability to think creatively, as measured by the Torrance Test of Creative Thinking.

Subjects

In the first term, subjects included all children and their teachers in the first 6 numerically ordered[1] classes at the School for Language and Hearing Impaired Children, New York City.

The experimental group was a randomly selected 50% sample of the 6 classes, with 18 in the experimental group and 18 serving as controls.[2] Their ages ranged between 8 and 15 years.

[1] five intervening classes were eliminated: 3, as required, because they were participating in the bilingual component of the project; 1 because its students had special learning disabilities; and 1 because the classroom teacher did not want to participate in the program.

[2] the total number of children in the 6 classes was 39. One child in the control group was transferred to another school during the term. Two children in the experimental group were eliminated because of absence from school, 1 had attended 5 of the art classes and the other had attended 3.

The groups were chosen by lot as follows: in each class the children were presented with a handful of pencils, their tips concealed. Half the number of pencil tips were wrapped with colored paper. Children who pulled the wrapped pencils became the experimental groups, while those who pulled the unwrapped pencils became the control groups, remaining with their teachers while the experimental children attended art classes.[1]

In the second term, subjects included all children in the 3 remaining eligible classes in the School, as well as the first 3 numerically ordered eligible classes in the School for Language and Hearing Impaired Children in Queens, New York.

Experimental subjects were a 50% sample of the 6 classes (N=19), randomly selected by the evaluator of the project. Unselected subjects served as controls. Their ages ranged between 8 and 16 years.

Project Activities

In the first term, art classes were taught 2 days a week, 3 classes a day, the participants attending 1 class a week for 11 weeks, October through December, 1972.[2] Although the classes had been scheduled for 20 weeks each term, the instructor was unable to teach for the proposed number of weeks because her time was required to research and develop the pre-post tests specified in the evaluation design prepared by the Bureau of Educational Research.

The evaluation design expanded the test of cognitive skills from 3 tasks to a 30-item criterion referenced test, and the teacher rating scale from 11 to 30 items. The designer had expected that an evaluator would develop the pre-tests scheduled for October and January, and the post-tests scheduled for January and June. The evaluator was not available, however, until January 24, 1973. Consequently, in September, the project coordinator-instructor researched the tests, improvised test materials, prepared the instruments for administering tests and recording responses, and administered the Torrance Tests and drawing tests (Tables V and VI) which were scored by others. In February, the evaluator requested detailed reports and required that additional tests be developed and administered, delaying the start of second term classes until March 6th.

[1] since 2 children in 2 of the classes had participated in the pilot study, they had separate lotteries, one joining the control group and the other joining the experimental group.

[2] October 3,5,10,12, 17, 24,26,31; November 2,8,9,14,16,21,28,30; December 5,7,12,14,19,21. If a child was absent for one class, he usually made up the absence on another day. Records were kept of each child's performance in each of the classes.

The art classes were scheduled for 40 minutes but on occasion, were extended to 60 minutes. During the art periods, control group children remained with their classroom teachers engaged in academic work.

The 6 classroom teachers participated in weekly in-service teacher-training workshops for one hour after school. They discussed objectives and methods of teaching art, and were guided in evaluating drawings and paintings for evidence of abilities and disabilities, attitudes, and educational needs. In January, they evaluated the drawing post-tests and pre-tests. Mrs. Ruth Weissman and Miss Marilyn Slapikas evaluated the test of ability to represent spatial relationships (Table VI). In addition, these teachers, together with Mrs. Remedios Gallo, Miss Barbara Ilgen, Miss Carol Schreck, and Miss Karen Jacobson evaluated the test of ability to form groups (Table V).

An educational assistant, Miss Jody Blank, a deaf young woman majoring in art at a New York City University, assisted in teaching the art classes.

The School's Integrating Teacher, Miss Edith Renna, administered the first term pre-test of cognitive skills (Tables I and II) to children in the 6 classes participating in the first term. A teacher of language and hearing impaired children, Mrs. Andrea Stein, administered the first term post-tests of cognitive skills and the second term pre-tests (Tables III, IV, IX, X, XI, XII).

Dr. Mildred Fairchild, professor of Art and Education at Teachers College, Columbia University, and Ms. Jane Field, art-therapist and painter, evaluated art work by the participants (Table VII).

The project coordinator-instructor taught the classes and conducted the workshops, working two days per week, September to December 1972, and 4 days per week thereafter. She also tabulated and analyzed the findings, kept individual records of the participants, administered the Torrance Tests and drawing tests, prepared the test instruments described above, and prepared this report.

In the second term, the program was suspended after two weeks because of illness. The coordinator-instructor was unable to resume teaching until May 1, 1973. In order to provide a maximum number of instructional periods in the remaining time, each participant is scheduled to attend two 40-minute art periods per week for 5 weeks, May 1 to 31. Since post-testing is scheduled to start May 31, this should provide a total of 12 art periods for each participant, including two weeks of instruction in March.*

Teaching one day per week, the instructor will teach 2 classes at the New york City School. The educational assistant and a substitute teacher will teach 3 classes a day 3 days a week at the Queens School, and 1 day a week at the New York City School. They will use the teaching procedures described in Chapter III, but with different materials to protect the validity of the pre-post test.

* In actuality only 9 art periods were provided in the second term due to unanticipated programming difficulties.

CHAPTER III

TEACHING PROCEDURES

In general, the approach to teaching was indirect rather than direct. Directive teaching was avoided for several reasons: to encourage thinking and exploratory learning, to obtain spontaneous responses, and to establish a classroom atmosphere in which independence and iniative would be self-rewarding.

The procedures consisted of drawing and painting tasks that were usually open-ended. When a specific solution was called for, directive teaching was usually limited to 5 or 10 minutes and followed by free choice art activity.

Corrections were never made on a student's work. Suggestions were sketched on the blackboard or scrap paper, and final decisions left to the student.

Two teaching procedures in each of the cognitive areas under examination will be discussed.

1. Grouping

The ability to form groups on the basis of function or class is one of the three basic structures from which all the branches of mathematics can be generated.* It also has particular significance in teaching language and hearing impaired children because the two fundamental kinds of aphasia are linked with disorders of verbal selection and combination. Receptive aphasia has been called a "similarity disorder", a disturbance of the ability to detect resemblances and make selections, an inability to analyze or break down a context, such as a sentence, into its constituent parts. On the other hand, expressive aphasia is associated with disturbances of the ability to synthesize or combine the parts into a whole. As might be expected, selecting and combining are said to be the two fundamental operations underlying verbal behavior (Jakobson, p.25).

Although verbal behavior may be the chief concern of linguists and neurologists, their observations have interesting implications for the visual arts. For if selecting and combining are the two fundamental operations underlying verbal behavior, they are also fundamental in the non-verbal behavior characteristic of art activities. The painter selects colors and shapes, and often selects representational images as well. He combines them into contexts, configurations that are interesting to look at and often meaningful.

Furthermore, selecting and combining are fundamental not only in language and the visual arts, but in creative thinking as well. The creative individual has been characterized as one who makes unusual leaps in associating experiences not commonly regarded as alike. In other words,

---

*page 1.

he has unusual capability for selecting and combining, regardless of whether he expresses his thoughts through language, visual art, or some other medium.

In the project, teaching procedures were intended to help children detect similarities and deal with them by combining related subjects on the basis of form or content, or both.

Selecting from an array of drawings

The children were shown two arrays of ink and watercolor drawings on 3 x 5 cards. On one table, the drawings included a variety of people and animals. On another table nearby, they included a variety of objects and passive animals, with about 30 cards in all. They were asked to select one or more cards from each array, then to draw or paint a picture that tells a story about them.

This procedure, but with different model drawings, was added to the first term post-test and included in the second term pre-post tests (Table V).

The first two art classes were structured in this way to encourage the children to select, combine, and represent. The rest of time, they grouped spontaneously without suggestions or interventions by the teacher.

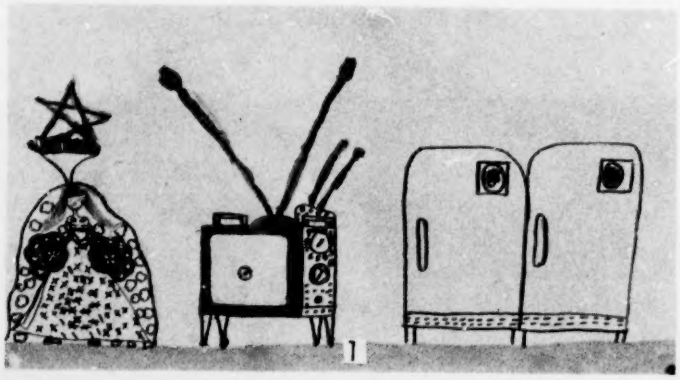
The children were also asked not to copy the model drawings but to use them in drawings of their own. This message may seem difficult to convey with pantomime and a minimum of language, but most children restructured the models in their first drawings, and all restructured them thereafter.

To illustrate, David, age 9, selected the bride from one array and refrigerator and television set from the other, titling his work, "Wedding Presents" (Fig. 1). Although the model drawing of the bride ended at her waist, (fig. 2), he shows her full length in an unusual gown. He also restructured the modest drawings on the cards, giving her an elaborate television set and two refrigerators.

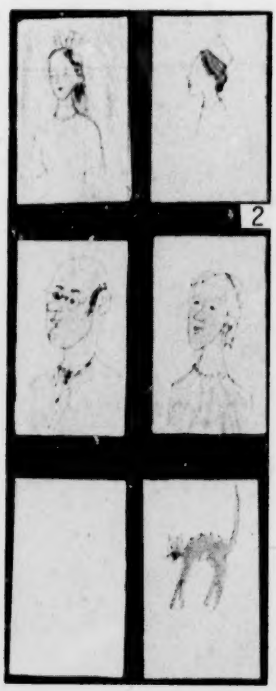
Two children selected the nurse, a head and shoulder profile drawing, but they restructured her and combined her with different objects in characteristic ways. Burt, age 13, added objects of his own--crutches (Fig.3). Ruben, age 11, provided furniture and script: on the door, "please don't wake up the babies"; on the wall, "please/ sh baby/ sleepy", and title, "the Babies Sitter" (Fig. 4). Both children seem to have selected and combined on the basis of function--what objects do or what can be done to them.

Three black children restructured the models into black people. As Bob, age 10, explained his first drawing, "mother and baby are lying down. Mother has an afro. That's all" (Fig. 5); and his second drawing, "the mother went away and left father to mind the baby for her". Kenny, age 8, drew a bride, combining her, without explanation, with an airplane. Jan, age 8, drew the nurse on a horse, explaining that she was riding to the hospital on a hospital horse (Fig. 6).

Victor and Tom both chose the mouse. Victor, age 8, added a bug



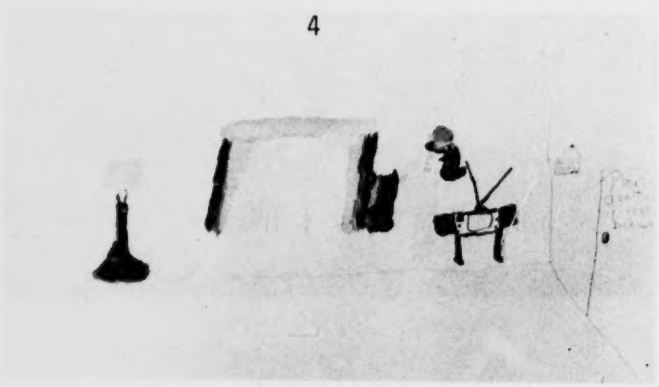
1



2

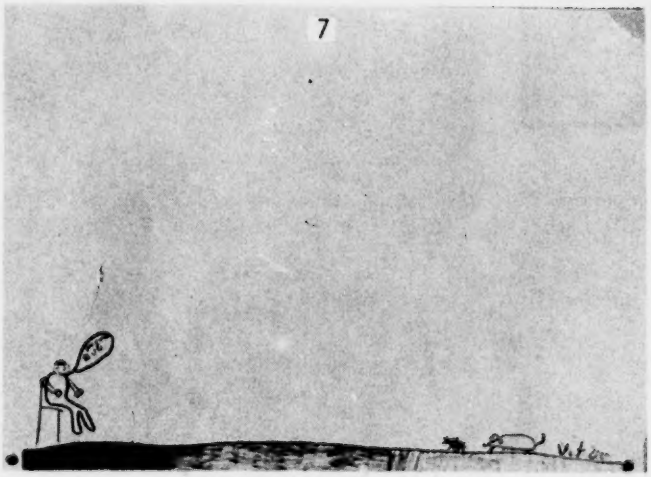
3

4

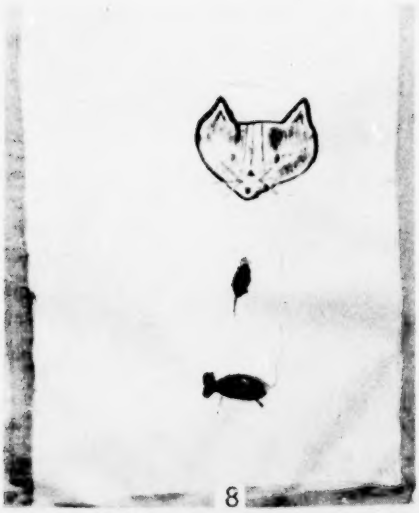


5

6



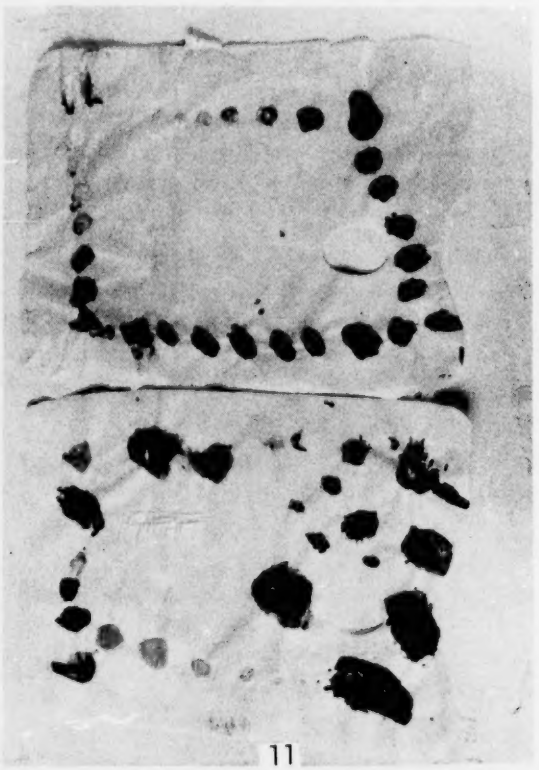
7



8

9

10



11

12

13

14

and a man, showing them very small on the bottom of his paper, the man at one end calling to the mouse and bug at the other. He may have selected and combined on the basis of what his subjects cannot do rather than what they can do. With most of his paper left blank, they suggest a collection of the small and weak, himself included at the end of the line (fig.7).

Tom, age 14, chose the cat as well as the mouse, combining them in a way that suggests the mice have been caught (Fig. 8). Although the model shows a whole cat in profile, Tom drew only its head fullface and large, enclosed with the mice in a border of blue paint. They are grouped into a unified whole on the basis of function or possibly class. Since the meaning of visual symbols is often obscure, without explanations, the cat and mouse may be symbols for events in Tom's life, or he may simply be saying, cats eat mice.

Ruth, age 9, also selected the cat but associated it with flowers rather than mice, with life rather than death. She said her painting showed, "my cat in a garden". She does not have a cat but talks about them often. Asked if she really had a cat, she replied, "what cat?" (Fig.9). This was her last painting. By way of contrast, Fig. 10 shows her first work, typical of the fragmentary drawings produced by many of the children who seemed unable, at first, to select on the basis of function or combine their selections meaningfully.

Placing Objects in Given Positions

The intention of this procedure was to develop concepts of space by observing, manipulating, and evaluating spatial relationships, using the edges of a sheet of paper as a frame of reference, and objects on the paper as points of reference.

The children were shown a cylinder and 2 building blocks on a sheet of paper, their outlines traced. They were asked to select the same objects and arrange them in the same way on their own sheets of paper, then trace their outlines.

Their drawings were then superimposed and held up to the light so that the children could compare their outlines with the model outlines. The teacher pointed out similarities and differences, overlapping, angles, and distances.

The procedure was repeated as a pre-test and training technique, then following other teaching procedures, repeated as a post-test to find out if there had been improvement in a child's awareness of spatial relationships.

Results were scored on a basis of 1 to 3 points for degree of overlap, and 1 to 3 points for correlation of angles and distances. The maximum possible score was 18.

In their first attempts, 9 of the 18 children received scores

of 6 points or less, 3 of them zero. In their last attempts, the lowest score was 10. Sixteen children showed improvement, 7 gaining 5 or more points.

The procedure was added to the first term post-test and included in the second term pre-post tests. (Tables III, IV, IX, X, Item J).

2. Sequential Ordering

The following procedures were intended to develop a child's ability to order sequentially, the second basic mathematical idea. They were also attempts to provide experiences in selecting, combining, discriminating and inventing.

Ordering Colors

On each worktable was a series of 5 cards in 1 color and 4 progressively lighter tints. The children were asked if the colors were the same or different. After similarities and differences had been considered, the cards were scrambled, and each child asked to put them back in order. This served as a pre-test.

Next, each child was given a palette knife and paper palette, a dab of white paint in the upper left corner and a dab of another color in the upper right corner. After the teacher demonstrated on her palette how to create sequential tints of color, each child was asked to mix tints of the color on his palette.

Then a second color, chosen by the child, was added to the lower right corner of his palette, and he was asked to find out how many colors he could invent by mixing the colors on his palette.

Finally, black was added in the lower left corner, and the children asked to complete the circle with shades of the second color, and shades and tints of grey.

The remaining time was devoted to free choice activity. Some children continued to mix colors, painting abstract patterns and designs. Others painted representational pictures. Just before the end of the period, the children were again asked to place the cards in order.

Of the 17 children presented with this experience, 5 were initially unable to put the colors in sequence, or, perhaps, did not understand what they were asked to do. At the end of the art period, 1 of the 5 children ordered the cards systematically, the others still mixed them haphazardly. Examples of both responses are shown in Figure 11.

About a month later, after further experience painting, the 5 children were again presented with color cards. All ordered a red series systematically, and 4 of the 5 ordered a green series systematically.

This procedure was added to the first term post-test and included in the second term pre-post tests (Tables III, IV, IX, X, Item I).

Locating a Doll on a Model Landscape

This procedure, used as a game, was based on an experiment by Piaget and Inhelder (1967, p. 421). Two identical landscapes were constructed on trays--mountains, rivers, paths, trees, and houses made from plaster, cardboard, matchsticks, and clay.

The child playing the game was asked to place his doll in the same position on his landscape as the doll on the other landscape placed by the teacher or another child. After a few trials, the child's landscape was turned 180 degrees, requiring him to locate his doll by relating it to parts of the landscape rather than his own position. Seventeen positions were marked by number on the teacher's model.

3. Spatial Orientation

The third basic structure from which the various branches of mathematics can be generated, involves ideas of space.

The young child's ideas of space are based on concepts of proximity, distance, enclosure, and so forth. He regards each object in isolation rather than as part of a comprehensive system. As he matures, he begins to consider an object in relation to specific points of view and external frames of reference. In coordinating objects rather than analysing individual objects, he develops ideas that Piaget calls concepts of projective and euclidean space, external to objects and independent of the movement of objects within a frame of reference. For example, a young child in drawing a line, relates it to a neighboring shape if he relates it at all. He does not think of it in relation to the edges of his paper.

About the age of 7, however, he begins to use the bottom of his paper as a frame of reference, drawing a parallel line to represent the ground, and relating his subjects to one another along this line, or drawing them on the bottom of the paper itself. With a frame of reference he can develop ideas of perspective and projective straight lines. Ruth's drawing, Figure 10, suggests the beginning of this development with 3 flowers along the bottom of her paper.

The ability to construct straight lines, parallels, and angles constitutes the preliminary phase of projective and euclidean space, according to Piaget, culminating in a single coordinated system embracing all objects in 3 directions--left-right, before-behind, and above-below (1967, p. 375).

Drawing an Arrangement of Objects from Observation

The objective of this procedure was to develop perceptual and representational skills, using the base plane, or "horizon", as a frame of reference.

On a table in front of the room, four objects were arranged:

3 cylinders of different heights, widths, and colors; and for interest, a bug made from a large pebble with movable eyes and legs. The arrangement was presented on an 18x24" drawing board with another board, supported by the wall, serving as backdrop.

The teacher demonstrated with a quick sketch of the arrangement on paper 9x12", thus reducing the scale. The children were also asked to make quick sketches on 9x12" paper, which served as a pre-test.

The arrangement was then placed in the center of the room, without a backdrop, surrounded by the work tables. The children were asked to draw the arrangement from at least 3 points of view. Thus, from one work table, the bug would appear to the left of a particular cylinder, and from another, to the right. From some points of view, it would be invisible, and so forth. A child's last sketch served as a post-test.

The first and last sketches were scored on the basis of 1 to 4 points for number of correct representations of the objects in the following relationships: above-below (horizon line), left-right, before-behind, distance, and proportion.

In their first sketches, 4 of the 16 children presented with this task were able to relate the objects correctly. After sketching from different points of view, 8 of the 12 children who initially demonstrated lack of ability, subsequently represented the relationships correctly.

This procedure, using different objects, became one of the second term pre-post tests (Table VI).

Horizontal and Vertical Orientation

This procedure was designed to help the children become aware that some verticals and horizontals remain constant in spite of changes in appearance or the angles of nearby objects. It was also an attempt to find out whether the children had spontaneously developed horizontal or vertical orientation, and if not, the stages they had reached, judging by Piaget's observations.

First, the children were asked to predict the positions water will assume when its container is tilted, by drawing the water in an outline drawing of bottles in various positions. They were also asked to draw a house on an outline drawing of a mountain. These tasks were adapted from experiments by Piaget and Inhelder (1967, pp. 379-418).

Then they were given various objects and invited to test out their predictions. These included a bottle partly filled with water, a plumb-line of weighted string suspended from a stick, a plaster "mountain", and toy animals and houses.

After examining and considering the objects for about 5 minutes, the children were asked to draw or paint a picture of someone fishing in a lake with a mountain nearby. Figures 12, 13, and 14, are some of the responses.

At the end of the period, the children were again asked to fill in the outline drawings of the bottle and the mountain.

This task was added to the first term post-test about a month later, and included in the second term pre-post tests. The results seem so interesting that they will be presented in detail on pages 25 and 26.

CHAPTER IV

EVALUATION PROCEDURES

Nine tests were developed and administered during the first term:

1. FIRST TERM PRE-TEST OF COGNITIVE SKILLS (Tables I and II)

A 30-item criterion referenced test containing 6 tasks related to the ability to conserve, group and order sequentially, with 10 items devoted to each ability under examination.

The ability to conserve was measured by 2 classic Piaget experiments, conservation of liquid (task A) and conservation of number (task B).

The ability to group was measured by adapting 2 experiments conducted at the Harvard Center for Cognitive Studies where investigators found that children progress from grouping objects according to perceptible qualities, such as shape or color, to grouping according to function--what objects do or what can be done to them. Eventually they progress to grouping objects according to class--the abstract, invisible qualities by which objects resemble one another. These investigators found that groupings based on perceptible qualities declined steadily from 47% at age 6 to 20% at age 11. At the same time, groupings based on function increased steadily from 30% at age 6 to 47% at age 11 (Bruner, 1967, p.79). Task C, was adapted from an experiment by Patricia M. Greenfield; task D was adapted from an experiment by Joan Rigney Hornsby.

The ability to order sequentially was measured by an experiment by Piaget (task E) and an experiment by Bruner and Kenny (task F).

The test was administered individually to the 18 experimental and 18 control children by the first week of October, 1972.

None of the test materials were used in the art classes.

2. FIRST TERM POST-TEST OF COGNITIVE SKILLS (Tables III and IV)

A 48-item criterion referenced test containing 10 tasks related to the ability to conserve, group and order sequentially.

In addition to the 6 tasks in the pre-test, the post-test included 4 additional tasks based on teaching procedures developed during the first term, and administered as pre-tests in the art classes. The tasks concerned vertical and horizontal orientation, sequential ordering of colors, placing objects in given positions, and conservation of clay.

The test was administered individually to the 18 experimental and 18 control children by the second week of January, 1973.

3. DRAWING TEST OF ABILITY TO SELECT, COMBINE, AND REPRESENT (Table V)

A drawing from imagination, evaluated for ability to select, combine, represent, and use language.

This task was adapted from the teaching procedure in which two arrays of model drawings were presented in the art class (page 10). The presentation, in the second art class, served as a pre-test for first term experimental children.

The test was administered to first and second term experimental and control groups in January, 1973.

4. DRAWING TEST OF ABILITY TO REPRESENT SPATIAL RELATIONSHIPS (Table VI)

A drawing from observation, evaluated for ability to represent left-right, above-below, before-behind, and proportional relationships.

This task was adapted from teaching procedures described on page 17. It was presented to experimental children on a pre-post test basis during the first term.

It was administered as a pre-test to second term experimental and control groups in February, 1973.

5. AN EVALUATION OF ART WORK BY AN ART THERAPIST-PAINTER, (Table VII)

Three drawings or paintings by each child in the first term experimental group were evaluated for ability to represent through art forms (items D, E, and F). They were his or her first and last work, and a work produced in mid-term. The 54 drawings and paintings were presented and numbered at random to hide the sequence in which they had been produced. They were evaluated in March, 1973.

6. AN EVALUATION OF ART WORK BY A PROFESSOR OF ART, (Table VII)

The same 54 drawings and paintings were evaluated in March, 1973, for ability to select, combine, and represent through art forms using the same instrument, Items A - F.

7. TEACHER RATING SCALE (Table VIII)

A 30-item rating scale containing items related to cognitive ability, attitudinal change, and language development, with 10 items devoted to each ability under examination. This scale was completed by the 6 teachers of first term experimental and control children in the first week of October, 1972, and the first week of January, 1973. It was completed by the 6 teachers of second term experimental and control children in February, 1973.

8. SECOND TERM PRE-POST TEST OF COGNITIVE SKILLS, (Tables IX and X)

A 30-item criterion referenced test containing 10 tasks related to the ability to conserve, group and order. The test was administered in January, 1973, individually to the 19 experimental and 19 control children.

9. ADDITIONS TO SECOND TERM PRE-POST TESTS OF COGNITIVE SKILLS (Tables XI and XII)

A 31-item test containing 10 tasks related to the ability to conserve, group, and order.

This test was developed at the request of the evaluator, and with her assistance. It was administered individually to the experimental and control children in March, 1973.

In addition, a standardized test and another teacher rating scale were administered.

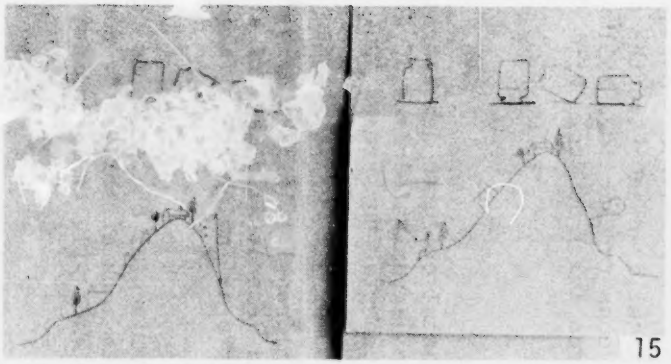
10. TORRANCE TEST OF CREATIVE THINKING

A 41-item test containing 3 tasks related to creative ability: fluency, flexibility, originality, and elaboration.

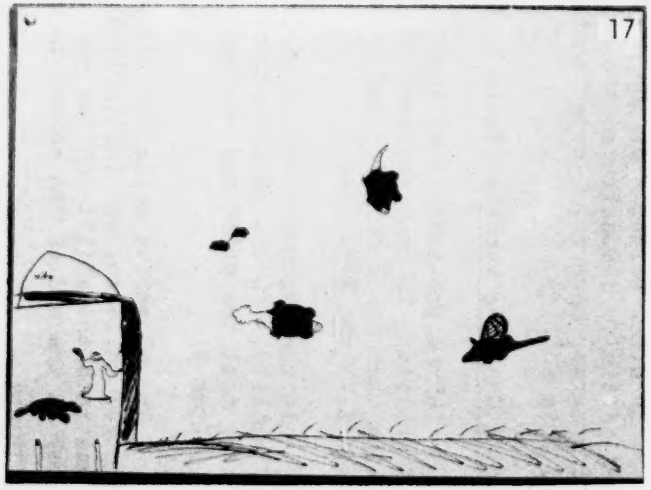
The test was administered as a group test to first and second term experimental and control groups; the pre-test, Figural Form A, in October and January; the post-test, Figural Form B, in January. Results were scored by the Personnel Press Scoring Service, University of Georgia, Athens, Georgia.

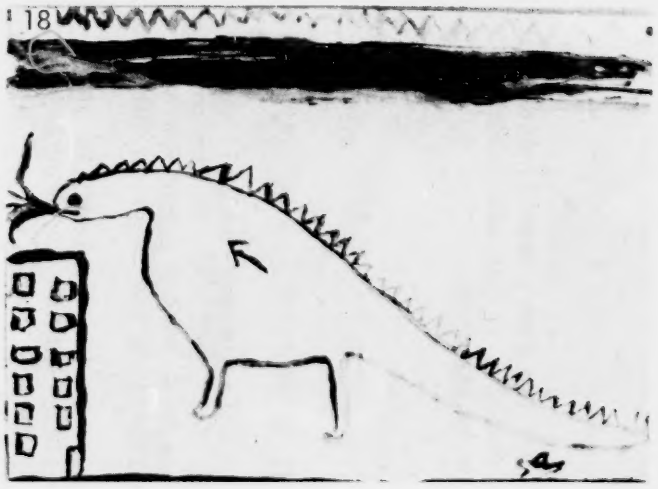
11. TEACHER RATING SCALE, II (Table XXXI)

A 5-item rating scale containing items related to skills in mathematics, reading, language, attitudes, and motor or visuo-spatial skill. Teachers in the participating classes were asked to evaluate the skills of their pupils before the program began, in September, 1972, and 4 months after the program ended, in May, 1973. Both evaluations were made in May.


15

16


17


18

CHAPTER V

RESULTS

The first term findings are presented in this chapter. Statistical analysis is not available, as of this writing, because the second term is in progress.

1. CONSERVING

Ability to Conserve Liquid (Table I, Item A)

In the pre-test, 15 of the 18 experimental children demonstrated lack of this ability. In the post-test, 11 demonstrated lack of ability. This suggests that 4 experimental children developed the ability to conserve liquid as indicated in Tables XIII and XIV, Item #3.

In the pre-test, 14 of the 18 control children demonstrated lack of ability. In the post-test, 17 demonstrated lack of ability. This suggests that no control children developed the ability to conserve liquid, and that 3 children seem to have lost the ability*, as indicated in Tables XV and XVI, Item #3.

In other words, 3 of the experimental children and 4 of the control children initially demonstrated the ability to conserve liquid. Following the art program, however, 7 experimental children and 1 control child demonstrated this ability.

Ability to Conserve Numbers (Table I, Item B)

In the pre-test, 2 of the 18 experimental children demonstrated lack of ability. In the post-test, no children demonstrated lack of ability, suggesting that the 2 children had learned to conserve numbers as indicated in Tables XIII and XIV, Item 5.

In the control group, 1 of the 18 children initially demonstrated lack of ability. In the post-test, no children demonstrated lack of ability, suggesting that the child had learned to conserve as indicated in Tables XV and XVI, Item 5.

The objective calls for 40% more experimental children, as compared with control children, who initially demonstrate lack of ability to conserve, to demonstrate the ability on the post-test.** This will be determined by the evaluator at the end of the second term.

---

*inconsistency in performance occurs frequently with these children

** page 6

The following measures of conservation are without pre-tests for control children since they were based on teaching and evaluating procedures developed during the first term. As indicated in Chapter IV, the tasks were presented to experimental groups in art classes as pre-tests, added to the post-tests administered to control and experimental groups, and included in the second term pre-post tests.

Ability to Conserve Solids (Table 3, Item G)

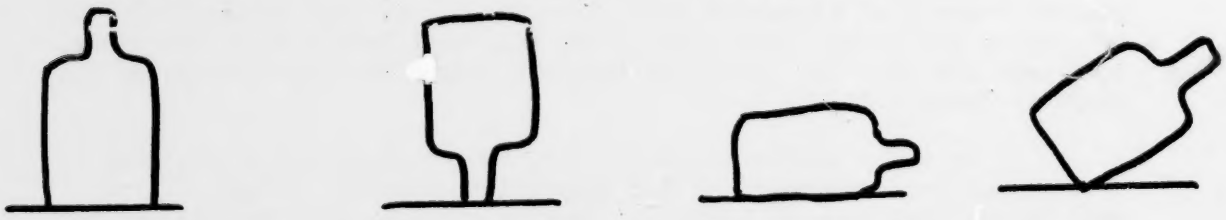
In the classroom pre-test, 15 of the 18 children demonstrated lack of ability to conserve clay. In the post-test, 9 demonstrated lack of ability, suggesting that 6 children developed this ability, as indicated in Table XVII, Item 32.

Of the 18 control children, 16 demonstrated lack of ability in the post-test, Table XVII, Item 32.

Horizontal Orientation

These results will be presented in detail since Piaget and Inhelder have broken down the ability into 5 stages of development as indicated in Table XVIII. The measure was based on teaching procedures described on page 18.

In the classroom pre-test, the children were asked to predict the level water would assume in a bottle by drawing the water level in outline drawings of a bottle in various positions. Only 3 of the 18 children represented water in all the bottles with a horizontal line. Piaget and Inhelder call this Stage IIIb, "the immediate prediction of horizontal and vertical as part of an over-all system of coordinates" (1967, p. 384).



Twelve children drew horizontal lines in 3 of the bottle outlines, but in the tilted bottle, they drew oblique lines. In other words, they were able to predict that water would be horizontal only when its surface was parallel with the bottle's sides. Although 8 children drew lines that were sharply oblique (Stage IIb), 3 children drew lines that were slightly oblique (Stage IIIa), suggesting that they were beginning to coordinate their predictions with a reference system outside the bottle. At a lower level, 2 children represented water with a line parallel to the base of the bottle even when it was lying on its

side (Stage IIa), and the lowest level, 1 child represented water with a round scribble (Stage I).

In the classroom post-test, the same day, after the children had manipulated a bottle half-filled with water, then painted pictures about someone fishing, two of the 15 children who initially failed to draw horizontal lines in all the bottles, subsequently drew horizontal lines, and 8 other children progressed to a higher level of development.

About a month later, these children and the control children were asked to make the same predictions as part of the addition to the first term post-test. This time, 11 of the 18 experimental children drew horizontal lines in all bottles, 5 drew oblique lines in the tilted bottle, 1 drew a line parallel with the base in the bottle on its side, and 1 scribbled.

In other words, the number of children unable to predict that water would remain level in spite of changes in the position of its container, declined from 15 to 7 while the number who apparently learned to coordinate their predictions with an external system of reference, increased from 3 to 11.

In the control group, 6 of the 18 children represented water as a horizontal line, 1 drew a sharply oblique line, 10 drew lines parallel to the base of the bottle, and 1 scribbled.

In terms of Piaget's stages of development, the experimental group seemed at the IIb level in the pre-test, with an average score of 3.27. In the post-test, they seemed at the IIIa level with an average of 4.16. Although the control group had not had a pre-test, it seemed at the IIb level with an average score of 3.00.

Vertical Orientation

In this task, the children were asked to draw a house on an outline drawing of a mountain with steep sides, its peak already occupied by a house and trees. This ability has also been broken down into stages by Piaget and Inhelder, and 2 intermediate stages have been added, as indicated in Table XIX.

In the classroom pre-test, 5 of the 18 experimental children drew houses that were vertical and apparently supported (Stage III); 6 drew houses that were vertical, but lacking support, or somewhere between vertical and perpendicular to the mountain slope (Piaget makes no reference to these responses, but they seem to be transitional stages between III and II); 6 drew houses perpendicular to the incline (Stage IIa); and one solved the problem by filling up a valley, providing the land to support his house.

In the classroom post-test, 5 of the 13 children who initially drew houses perpendicular or almost perpendicular to the mountain slope, subsequently progressed to higher stages of development, 3 of them progressing from 2 points to 5.

About a month later, on the post-test administered to both control and experimental groups, 12 of the 18 experimental children drew houses that were vertical and supported, 5 drew houses vertical without support or between vertical and perpendicular, and 1 drew the house perpendicular to the incline.

In other words, the number of children unable to predict that a house on a mountain slope would be vertical, decreased from 13 to 6 while the number who apparently learned to coordinate their predictions with an external system of reference increased from 5 to 12.

In the control group, 3 of the 18 children drew houses vertical and supported, 8 drew houses vertical without support or between vertical and perpendicular, and 7 drew houses perpendicular to the slope.

In the stage of development, the experimental group seemed initially at the Stage II level with scores averaging 3.29, and subsequently close to the Stage III level, with scores averaging 4.44, while the control group seemed at the Stage II level with scores averaging 3.16.

It is interesting to note that although 11 children demonstrated horizontal orientation and 11 demonstrated vertical orientation, they were not the same children. Only 8 children performed at the Stage III level on both tasks. Some children with good horizontal orientation showed poor vertical orientation, and vice versa. Also, some children progressed in one dimension and not the other. Figure 15 illustrates the responses of two classmates; one at Stage III vertically but less than IIa horizontally; the other at Stage IIa vertically and IIIb horizontally.

2. GROUPING

Ability to Group 3 Objects on the Basis of Class or Function (Table I, Item C)

In the pre-test, 10 of the 18 experimental children demonstrated lack of ability by grouping on the basis of perceptible attributes. In the post-test, 6 children demonstrated lack of ability, suggesting that 4 had learned to group on this basis, as indicated in Tables XIII and XIV, Item 13.

In the pre-test, 10 of the 18 control children demonstrated lack of this ability. In the post-test, 6 demonstrated lack of ability, suggesting that 4 had learned to group on this basis, (Tables XV and XVI, Item 13).

Ability to Group 12 Objects on the Basis of Class or Function (Table I, Item D

In the pre-test, 3 of the 18 experimental children demonstrated

lack of ability by grouping on the basis of perceptible attributes. In the post-test, 3 demonstrated lack of ability, but 2 of these were different children, suggesting that 2 children had developed ability and 2 had lost the ability, as indicated in Tables XIII and XIV, Item 18.

In the pre-test, 4 of the 18 control children demonstrated lack of this ability. In the post-test, 2 children demonstrated lack of ability, suggesting that 2 children had learned to group on this basis (Tables XV and XVI, Item 18).

The following measures are without pre-tests for control children since they were based on procedures developed during the first term. The tasks were presented to experimental children in art classes as pre-tests, added to the post-tests administered to control and experimental children, and included in the second term pre-post tests.

Ability to Select on the Basis of Class or Function (Table V)

In the pre-test, 7 of the 18 experimental children demonstrated lack of ability, scoring 1 or 2 points, as indicated in Table XX. In the post-test, 2 demonstrated lack of ability, as indicated in Table XXI. This suggests that 5 of the 7 children developed the ability. Furthermore, they selected on the basis of an idea, scoring 5 points, as did 10 other children, as indicated in Table XXI.

The number of experimental children who initially selected on the basis of perceptible attributes declined from 7 to 2, while the number who selected on the basis of class or function increased from 11 to 16.

In the control group, 6 of the 18 children demonstrated lack of this ability on the post-test, scoring 1 or 2 points; 5 scored 3 points, and 7 scored 5 points, as indicated in Table XXI.

Ability to Combine on the Basis of Base Line or Over-All Coordination (Table V)

In the pre-test, 5 of the 18 experimental children demonstrated lack of ability, producing fragmentary drawings scored 1 or 2 points, as indicated on Table XX. In the post-test, 1 demonstrated lack of ability, as indicated on Table XXI. This suggests that 4 of the 5 developed the ability. Furthermore, 3 of the 4 combined on the basis of over-all coordination, scored 5 points, and 1 combined on the basis of a base line, scored 3 points (Table XXI).

In other words, the number of experimental children who initially combined on the basis of proximity, producing fragmentary drawings, declined from 5 to 1, while the number who initially combined on the basis of over-all coordination increased from 5 to 11.

In the control group, 10 of 18 children demonstrated lack of this ability, scoring 1 or 2 points, as indicated in Table XX; 4 combined on the basis of a unified whole, scoring 5 points.

Ability to Represent at the Level of Reconstruction or Transformation (Table V)

In the pre-test, 6 of the 18 experimental children demonstrated lack of ability, representing on the basis of description or imitation (scored 1 or 2 points), as indicated in Table XX.

In the post-test, none demonstrated lack of ability, as indicated in Table XXI, suggesting that the 6 children developed the ability, 3 at the level of reconstruction (3 points) and 3 at the level of transformation (5 points). In other words, the number who represented at the level of description declined from 6 to 0, with 8 demonstrating ability to reconstruct, and 12 demonstrating ability to transform.

In the control group, 6 of the 18 children represented at the level of description, 8 at the level of reconstruction, and 4 at the level of transformation, as indicated in Table XXI.

Ability to Select, as Evaluated by an Art Educator (Table VII)

In their first drawings or paintings, 11 of the 18 experimental children demonstrated lack of ability to select on the basis of functional attributes or ideas, as indicated in Table XXII. In drawings or paintings produced at mid-term or the end of the first term program, 1 child demonstrated lack of ability.

In other words, the number who initially selected on the basis of perceptible attributes (scored 1 or 2 points) declined from 11 to 6, while the number who demonstrated ability to select on the basis of an idea (logical or illogical, storytelling or abstract, scored 5 points), increased from 4 on the first drawing or painting to 10 on the last.

Ability to Combine, as Evaluated by an Art Educator (Table VII)

In their first drawings or paintings, 6 of the 18 experimental children demonstrated lack of ability to combine on the basis of base line or over-all coordination, as indicated in Table XXII. In drawings or paintings produced at mid-term or at the end of the first term program, none of the children demonstrated lack of ability.

In other words, the number who initially produced fragmentary drawings or paintings (scored 1 point) declined from 6 to 0 while the number who produced drawings or paintings demonstrating over-all coordination (scored 4 or 5 points) increased from 10 to 18 (Table XXII).

The ability to represent, as evaluated by an art educator and an art therapist, is presented on page 33.

3. ORDERING

Ability to Order a Series of Sticks (Table I, Item E)

In the pre-test, 7 of the 18 experimental children demonstrated lack of ability to form a single sequence using a systematic approach. In the post-test, 2 children demonstrated lack of this ability, suggesting that 5 developed the ability to order sequentially, as indicated in Tables XIII and XIV, Item 22.

In the pre-test, 11 of the 18 control children demonstrated lack of this ability. In the post-test, 5 demonstrated lack of ability, suggesting that 6 children developed the ability to order sequentially, as indicated in Tables XV and XVI, Item 22.

Ability to Order a Matrix (Table I, Item F)

In the pre-test, 8 of the 18 experimental children demonstrated lack of ability to transpose the matrix, 4 demonstrated lack of ability to reproduce the matrix in its original position, and 1 demonstrated lack of ability to replace the objects, as indicated in Table XIII, Items 25, 24, and 23.

In the post-test, 5 of the 18 experimental children demonstrated lack of ability to transpose the matrix, 1 demonstrated lack of ability to reproduce the matrix, and none demonstrated lack of ability to replace the objects, as indicated in Table XIV, Items 25, 24, and 23.

In the pre-test, 10 of the 18 control children demonstrated lack of ability to transpose the matrix, 6 demonstrated lack of ability to reproduce the matrix, and none demonstrated lack of ability to replace the objects, as indicated in Table XV, Items 25, 24, and 23.

In the post-test, 10 of the 18 control children demonstrated lack of ability to transpose the matrix, 5 demonstrated lack of ability to reproduce the matrix, and none demonstrated lack of ability to replace the objects, as indicated in Table XVI, Items 25, 24, and 23.

The following measures are without pre-tests for control children since they were based on teaching procedures developed during the first term. The tasks were presented to experimental children as pre-tests in the art classes and added to the post-tests administered to control and experimental children. They also have been included in the second term pre-post tests.

Ability to Order a Series of Colors (Table III, Item I)

In the pre-test, 5 of the 18 experimental children demonstrated lack of ability to order the colors sequentially. In the post-test, 1 child

demonstrated lack of ability, 1 was able to order a series correctly through trial and error, and 15 were able to order a series systematically, starting with one card and working up or down from it, as indicated in Table XVII, Items 43, 44, and 45.

In the post test, 4 of the 18 control children demonstrated lack of ability to order systematically, none were able to order through trial and error, as indicated in Table XVII, Items 43, 44, and 45.

Ability to Place Objects in Given Positions (Table III, Item J)

In the classroom pre-test, 9 of the 18 experimental children demonstrated lack of ability, as indicated on page 15 . In the first term post-test, none of the children demonstrated lack of ability, as indicated in Table XVII, Items 46, 47, and 48.

In the post-test, 5 of the control children demonstrated lack of ability, as indicated in Table XVII, Items 46, 47, and 48.

Ability to Represent Spatial Relationships (Table XXX)

In the classroom pre-test, the children's first attempt to draw the arrangement of objects from observation, 12 of the 16 children attending the art class demonstrated lack of ability. In the classroom post-test, their last attempts, 4 children demonstrated lack of ability.

4. TEACHER RATING SCALE (TABLES VIII AND XXXI)

Language Development

In the pre-test, the average score of the 18 experimental children was 3.29. In the post-test, their scores averaged 3.31 (Tables XXIII and XXIV).

For the 18 control children, the average score was 3.12 on the pre-test and 3.13 on the post-test (Tables XXV and XXVI).

Cognitive Ability

In the pre-test, the average score of the experimental children was 3.07; in the post-test, 3.20.

For the control children, the average score was 2.73 on the pre-test and 2.94 on the post-test.

Attitudinal Change

In the pre-test, the average score of the experimental children was 3.75; in the post-test, 3.78.

For the control children, the average score was 3.51 on the pre-test and 3.59 on the post-test.

At the end of the term, the teachers were asked to evaluate, anonymously, the procedures discussed in the weekly workshops and used in the art program. Their written comments follow:

#1. Evaluating the children in early October of the school year seems to be not so reliable because the teachers don't know the children that much. At that time, the teacher may have been a little lenient for the"benefit of doubt". This January evaluation is much more of value because most of the scores given to each child are based on his performance over a longer period of time.

Generally speaking, the form we filled in for evaluating the children is subjective. The mood of the teacher could have affected the grading too.

#2. I have no suggestions for improving the workshop for I found it valuable experience both personally and professionally.

I feel if the questions required a phrase or short sentence as an answer, it would be more objective.

#3. How do we transfer this valid learning experience into more concrete classroom experiences? How do we build upon the language expressed through art? The program unveiled a good deal of insight into the child--his perceptions of himself and the world around him. I do think the workshops (some periods) can be spent discussing, sharing, ideas on how to carry over the experience into the classroom. I think that time was perhaps misspent airing personal teacher-pupil problems.

In respect to the questionnaire, it can be a very subjective tool and not necessarily valid. In some of the nonverbal activities, generally, the children have had little exposure to such experiences (except, of course, the experimental group). Perhaps that category can be split into 2 categories (with different titles).

#4. I would have been interested in further investigation of the methodology of the art program. I feel we spent too much time on the product of the student's work, rather than your knowledge and insight into the procedures to elicit this work.

#5. I enjoyed the workshops and the analysis of the children's art work. A written outline of the particular areas of Piaget's theories used in the course with the children would be helpful.

#6. The children enjoyed the weekly art sessions. I would suggest that a different policy for choosing the children be investigated. One child in my class who would have benefited from the program was not picked.

Mathematics, Reading, Language, Attitudes, and Motor or Visuo-Spatial Skill

Between September, 1972, before the art program began, and May, 1973, 4 months after it ended, experimental children gained 19.5 points in mathematics while control children gained 16 points; 15.5 points in reading whilecontrols gained 14 points: 15.5 points in language while controls gained 9.5 points; 13 points in attitude while controls gained 7 points; 17 points in motor or visuo-spatial skills while controls gained 7 points. The average gain of experimental children was 4.52 points while the average gain of control children was 2.97 points. Burt, who gained 15 points, was scored 0 in Reading in September and 1 in the other skills; scored 3, 4, or 5 in all skills in May, as indicated in Table XXXI. His teacher wrote the following comment: "Billy can't read a word when shown without a picture last September. Now he is on Book 7, Preprimer level of the Bank Street Series".

5. CREATIVE ABILITY

As Measured by Torrance Test of Creative Thinking

In the pre-test, children in the experimental group received an average score of 46.67 (Table XXVII). In the post-test, their scores averaged 48.45.

In the pre-test, children in the control group received an average score of 43.52*. In the post-test, their scores averaged 46.67, (Table XXVIII).

As Measured by a Professor of Art and Education (Table VII)

Eleven of the 18 experimental children demonstrated gain in ability to represent objects or events. Three children whose first drawings or paintings were rated 1 (descriptive, imitative, learned, impersonal), subsequently were rated 3 (goes beyond description, elaborates, edits). Six children whose initial work was rated 1, were subsequently rated 5 (goes beyond restructuring) Table XXII.

Seven children demonstrated gain in ability to represent attitudes, their first drawings or paintings rated 0. Nine works represented solitary or isolated people or animals; 2 represented villains, victims, weapons, danger, injury or threat of injury; 7 represented heroes, heroines, escapes, romances, etc; 4 showed omissions or distortions; and 6 showed ability to express a central idea effectively, (Table XXII).

*1 child in the experimental group received the unusually high score of 100 in Elaboration on both pre-test and post-test, accounting, in part, for the difference in scores of experimental and control groups.

Thirteen children demonstrated gain in ability to represent thoughts and feelings through art forms. Five children whose first drawing or painting was rated 1 (commonplace form or content), were subsequently rated 5 (highly skillful, exploratory, or sensitive to art qualities) (Table XXII).

As Measured by an Art Therapist-painter (Table VII)

Eleven of the 18 experimental children demonstrated gain in ability to represent objects or events. Six children whose first drawing or painting scored 1 or 2 (descriptive, imitative, etc. or slightly above), subsequently scored 5 (imaginative, highly personal, etc.), as indicated in Table XXIX.

Six children demonstrated gain in ability to represent attitudes, their first drawingsor paintings scored 0. Three works were found to represent solitary or isolated people or animals; 8, villains, victims, danger, etc.; 6, heroes, heroines, escapes, etc.; 8, omissions or distortions; and 13, ability to express a central idea effectively. (Table XXIX).

Twelve demonstrated gain in ability to represent thoughts and feelings through art forms. Six children whose first drawings or paintings were scored 1 point (commonplace form or content), were scored 5 points (highly skillful, exploratory, or sensitive to art qualities) in their last drawing or painting (Table XXIX).

The art work of one child, Victor, age 8, may serve to illustrate these evaluations. His first drawing, Figure 16, was rated 1 by both art specialists in all categories; demonstrating lack of ability to select on the basis of class or function, or combine on the basis of base line or over-all coordination, or represent beyond the level of description in commonplace form.

His second work produced in mid-term, was rated 1 in ability to select, 3 in ability to combine, 1 or 2 in ability to represent, and 1 for sensitivity and skill (Fig. 17).

His last painting, Figure 18, was rated 5 by both art specialists in all categories; ability to select at the level of an idea (note the figure of a man, bottom right, who has shot the dinosaur with an arrow), ability to combine at the level of transformation, and skillful, exploratory, and sensitive to art qualities, as well as expressive of a central idea.

RESPONSES OF INDIVIDUAL CHILDREN

It may be useful to illustrate these findings by summarizing the performances of individual children.

BETTY

age 13, receptive impairment and hearing loss at level of 78 dB in better ear.
IQ: 64 WISC, 69 Leiter, MA 7¼ at CA 12
"low level of functioning with difficulties in perceptual-motor and abstract-conceptual areas".

1. Demonstrated lack of ability on pre-test, ability in post-test in:

   conserving liquid, conserving solids
   ordering colors
   selecting (Tables XX, XXII)(1-5)
   combining (XXII)(1-5)
   Art sensitivity and skill (XXII, XXIX)

2. Demonstrated other gain in ability in:

   vertical orientation, from 3 to 4
   representing objects or events, from 1 to 3
   placing objects in given positions 35% to 100%
   Torrance Test of Creative Thinking,
     fluency, from 30 to 52
     flexibility, from 37 to 50
     originality, 37 to 40
     elaboration, 40 to 44

Teacher Rating Scale: ability to comprehend words and phrases, follow instructions, find the right word, combine words into sentences, use connective words, sequence events, explain thoughts, discuss hypothetical questions, detect similarities between objects, recognize that appearances may be deceiving, associate new information, retain information, solve problems, engage in imaginary play, originate ideas, work independently, control emotions, tolerate frustration, and self-confidence.

3. Demonstrated ability on pre-test of:

   grouping 12 objects
   conserving numbers
   ordering sticks
   transforming matrix

4. Demonstrated little or no ability or improvement in:

   horizontal orientation
   representing spatial relationships (left-right, from 4 to 3; before-behind, from 0 to 3; above-below, from 4 to 2; proportion unchanged at 3)
   grouping 3 objects

ROY

age 12, expressive impairment, hears, has difficulty remembering words long enough to understand questions,
IQ: "dull normal"

1. Demonstrated lack of ability on pre-test, ability on post-test in:

   art skills and sensitivity, from 1 to 5

2. Demonstrated other gain in abilbility in:

   horizontal orientation
   representing objects or events from 3 to 5, Table XX
   from 1 to 4, Table XXII
   from 2 to 5, Table XXIX
   placing objects in given positions, from 33% to 88%
   Torrance Test of Creative Thinking, fluency, from 30 to 34
   flexibility, from 33 to 39
   originality, from 42 to 44
   ordering colors (through trial and error, not systematically)

3. Demonstrated ability on pre-test of:

   vertical orientation (rated 5 but dropped to 2 on post-test--his drawing is on left in Figure 15)
   ordering sticks, conserving numbers

4. Demonstrated little or no ability or improvement on:

   Teacher Rating Scale
   can reproduce matrix, no change
   selecting, combining inconsistent (Table XX, 1 no change; Table XXII, 1 to 5, 4 to 5)
   conserving liquid
   conserving solids

It is interesting to note that, by mistake, Roy was given the second term additional pre-test. Although two weeks earlier in the first term post-test, he showed little ability, he demonstrated ability in all of the 10 tasks, including conservation of liquid and solids, double classification, and sequential ordering of circles, triangles, colors, pebbles, barrels, and hexagons. This seems to illustrate the inconsistency which seems characteristic of these children, and to demonstrate that even though it is not often evident, Roy does have the ability to conserve and order sequentially, as well as group on the basis of function or idea.

VICTOR

age 8, receptive impairment, severe sensori-neural hearing loss secondary to maternal rubella, profound speech and language delay secondary to hearing

loss and central language problem. R 76dB, L95dB.
IQ: above average.

1. Demonstrated lack of ability on pre-test and ability on post-test in:

ordering colors

2. Demonstrated gain in ability as rated on scales of 1 to 5 points:

horizontal orientation, from 3 to 5
vertical orientation, 3 to 4
selecting (Table XXII), 1 to 5
combining " 1 to 5
representing " 1 to 5
representing (Table XXIX) 1 to 5
sensitivity and skill (Table XXIX) 1 to 5
art sensitivity and skill (Table XXII) 1 to 5

other gains in ability:

overlapping blocks, 33% to 75%
Torrance Test, fluency, from 47 to 55
elaboration, from 46 to 50
Teacher Rating Scale:
nouns (use of), synonyms, antonyms, from 1 to 3
recognizing that appearances may be deceiving, 1 to 2

3. Demonstrated ability on pre-tests of:

grouping 3 objects
grouping 12 objects
conserving numbers
selecting, combining, and representing objects

4. Demonstrated little or no ability or improvement

conserving liquid
conserving solids
ordering sticks
transposing matrix
flexibility and originality

RUTH

age 9, receptive and expressive impairment, poor auditory receptive skills, difficulty with motor and behavorial expression.
IQ: 75

1. Demonstrated lack of ability on pre-test and ability on post-test in:

conserving numbers, grouping 12 objects

2. Demonstrated gain in ability on post-test as rated on scales of 1 to 5 points:

vertical orientation, 2 to 3
selecting (Table XXII) 1 to 5
combining " 1 to 5
representing " 1 to 5
representing (Table XXIX) 1 to 5
representing (Table XX) 2 to 3
sensitivity and skill (Table XX) 1 to 5
sensitivity and skill (Table XXII) 1 to 5

other gains in ability

overlapping blocks, 22% to 75%
Torrance Test of Creative Thinking: fluency, from 24 to 28
flexibility, 25 to 30
originality, 32 to 39
elaboration, 31 to 39

Teacher Rating Scale: puts objects in sequence, from 1 to 2
uses nouns, synonyms, antonyms, 1 to 2
controls emotions, from 2 to 5
tolerates frustration, 2 to 5
cooperates with other children, 4 to 5
interested in learning language, 4 to 5

3. Demonstrated ability in the pre-test:

none

4. Demonstrated little or no ability or improvement:

conserving liquid
conserving solids
grouping 3 objects
ordering sticks
reproducing matrix
ordering colors
horizontal orientation
combining, selecting (Table XX)
representing spatial relationships

TOM

age 14, receptive and expressive impairment and hearing loss R87dB, L 95dB) IQ: 97 WISC. Bender Gestalt showed no perceptual difficulty. Inadequate retention of words, confuses classroom instructions, reads poorly.

1. Demonstrated lack of ability on pre-test, ability on post-test in

conserving solids

2. Demonstrated gain in ability as rated on scales of 1 to 5 points

horizontal orientation, from 3 to 4 points
selecting on basis of class or functio . from 1 to 5
combining on basis of over-all coordination, 1 to 5
representing objects, from 1 to 3, 3 to 5, 4 to 5
art skill and sensitivity, from 4 to 5

Teacher Rating Scale: recognize that appearances may be deceiving, from 2 to 4
engage in imaginary play, 2 to 4
originate ideas, 2 to 5
use connective words, 2 to 4
sequence events, 3 to 4
be playful, humorous, 1 to 2
work independently, 3 to 4; tolerate frustration, 2 to 4
cooperate with other children, 3 to 4, control emotions, 2 to 3

other gains in ability

Torrance Test of Creative Thinking: fluency from 42 to 57
flexibility, from 45 to 57
originality, from 41 to 69

3. Demonstrated ability on pre-tests of:

conserving liquid
conserving number
vertical orientation
ordering sticks
ordering numbers
transposing and constructing a matrix
placing objects in given positions
representing spatial relationships
grouping 12 objects
selecting
combining

4. Demonstrated little or no ability or improvement

grouping 3 objects

RICK

age 12, receptive and expressive impairment, hears and understands. Extremely limited noun vocabulary, marked handicap when asked questions that call for verbal reply. Motor coordination poor: Bender-Gestalt IQ65 Merrill-Palmer scale, possible neurological impairment on perceptual-motor level.

1. Demonstrated lack of ability in pre-test, ability in post-test:

none

2. Demonstrated gain in ability

representing spatial relationships, from 70% to 100%
overlapping blocks, from 66% to 75%
representing (Table XXII), from 4 to 5
Torrance Test of Creative Thinking, fluency, from 28 to 67
flexibility, 35 to 50
originality, 35 to 50

Teacher Rating Scale: puts objects in sequence, from 3 to 4
associates new information, 3 to 4
solves problems, 2 to 3
uses nouns, synonyms, antonyms, 2 to 3
combines words into sentences, 2 to 3

3. Demonstrated ability in the pre-test of:

conserving liquids, conserving numbers, conserving solids
grouping 3 objects/grouping 12 objects
ordering sticks, transposing matrix, ordering colors
horizontal and vertical orientation
selecting (Tables XX and XXII)
combining (Table XXII)
representing (Table XXIX)
sensitivity and skill (Tables XXII and XXIX)

4. Demonstrated little or no ability or improvement

combining and representing (Table XX)

DAVID

age 9, moderate to severe receptive and expressive impairment. Speech regressed following surgery for tumor removal of eye when less than two years old. High degree of auditory inattention. MA 50 months, CA 60 months, Merrill-Palmer scale.

1. Demonstrated lack of ability on pre-tests, ability on post-tests:

sequential ordering of sticks, conserving numbers

2. Demonstrated gain in ability on post-tests as rated on scales of 1 to 5 points:

horizontal orientation, from 3 to 5
vertical orientation, 2 to 5
select (Table XXII), 1 to 5
select (Table XX), 3 to 5
combine (Table XXII) 4 to 5
art sensitivity and skill (Table XXII) 3 to 5

other gains in ability:

representing spatial relationships from 40% to 100%
from replacing to restructuring a matrix
overlapping blocks, from 66% to 75%
Torrance Test of Creative Thinking: fluency, from 28 to 38
flexibility, 33 to 44
originality, 38 to 45
elaboration, 50 to 51

3. Demonstrated ability on pre-tests of:

grouping 3 objects, grouping 12 objects
representing art sensitivity, and skill (Table XXIX)

4. Demonstrated little or no ability or improvement in:

conserving liquid, conserving solids, ordering colors, combining (Table XX), Teacher Rating Scale.

DAN

age 15, expressive impairment, hears and understands. IQ: 100 Nebraska; Bender-Gestalt indicates neurological deficiency, residual frontal lobe damage to central nervous system.

1. Demonstrated lack of ability on pre-test, ability on post-test:

grouping 3 objects
ordering colors
placing objects in given position

2. Demonstrated gains in ability as rated on scales of 1 to 5 points:

horizontal orientation, from 3 to 5
vertical orientation, from 2 to 5
ability to select on the basis of class or function, from 1 to 5

Teacher Rating Scale: ability to group on basis of class or function
ability to put objects in sequence

ability to use connective words
ability to discuss hypothetical questions
ability to express his ideas

other gains in ability:

representing spatial relationships, from 65% to 100%

3. Demonstrated ability in pre-tests of:

grouping 12 objects from an array
conserving numbers and solids
ordering sticks and colors
ability to transpose a matrix
ability to combine on basis of over-all coordination
ability to select on the basis of an idea

4. Areas in which he demonstrated little or no ability or improvement:

conserve liquid
art skills and sensitivity
Torrance Test of Creative Thinking

ELMER

age 12, expressive impairment, hears and understands. IQ:85 WISC, difficulty with visual motor coordination. Bender-Gestalt indicates slow, painstaking, compulsive drawing at 4 year level, CA 9.

1. Demonstrated lack of ability on pre-test, ability on post-test:

conservation of solids

2. Demonstrated gain in ability in:

placing objects in given positions, from 33% to 100%
horizontal orientation, from 3 to 5 points
vertical orientation, from 4 to 5
selecting on the basis of an idea, from 3 to 5 (Table XX)
selecting on function, from 1 to 3 (Table XXII)
combining 3 to 5, 4 to 5
representing

Teacher Rating Scale: ability to group on the basis of class or function, put objects in sequence, recognize that appearances may be deceiving, concentrate, retain information, solve problems, work independently, self-confidence, ability to represent spatial relationahips from 60% to 100%.

3. Demonstrated little or no ability or improvement:

conserving liquid
art sensitivity and skill
Torrance Test of Creative Thinking

EVE

age 13, congenital aphasia with receptive and expressive components and hearing loss.(R 63 dB, L50 dB) IQ: 80 Stanford Binet; 90, Merrill Palmer Performance Scale, poor memory span.

1. Demonstrated lack of ability on pre-test, ability on post-test:

ability to group 3 objects on the basis of class or function
ability to place sticks in sequential order
ability to reconstruct and transpose a matrix

2. Demonstrated gain in ability on post-tests:

ability to place 3 objects in given positions from 50% to 100%
Torrance Test of Creative Thinking: fluency, from 30 to 52
flexibility, 35 to 40
originality, 43 to 50

Other gains rated on scales of 1 to 5 points:

Teacher Rating Scale:
sequencing events, from 4 to 5
detecting similarities, 4 to 5
grouping on the basis of class or function 3 to 5
putting objects in sequence, from 3 to 5
recognizing that appearances may be deceiving from 2 to 4
associating new information, from 2 to 3
concentrating, 3 to 5

Also, Items #2-9 in language development and Items #21-24 in attitudinal change (see Tables XXIII and XXIV)

vertical orientation, from 2 to 5
representing objects or events from 4 to 5 (Table XX) and from 3 to 4 (Table XXII)
art skill and sensitivity, from 3 to 4 (Table XXII)

3. Demonstrated ability in pre-test of:

Torrance Test of Creative Thinking; elaboration scored 100+ in pre-test

(next closest score was 72)
representing spatial relationships 100% on pre-test,
selecting, scored 5 (Tables XX and XXII)
Combining, scored 5 (Tables XX and XXII)
Conserving numbers

4. Demonstrated little or no ability or improvement in:

conserving liquid
conserving solids
grouping 12 objects
horizontal orientation
art skill and sensitivity

RUBE:

age 11, receptive impairment and hearing loss (R90dB, L 85 dB) WISC 87, has difficulty making associations, memory wanes in short time.

1. Demonstrated lack of ability on pre-test, ability on post-test:

conserving liquid
grouping 3 objects/grouping 12 objects
ordering sticks, transposing a matrix

2. Demonstrated gain in ability on post-test as rated on scales of 1 to 5 points:

vertical orientation, from 2 to 5
selecting (Table XX) from 3 to 5
combining (Table XX), 1 to 5
representing (Table XX) 3 to 5
representing(Table XXIX) 1 to 4
sensitivity and skill (Table XXIX) 1 to 5
sensitivity and skill (Table XXII) 1 to 2

Teacher Rating Scale: detects similarities, 3 to 4
associated new information, 3 to 4
groups on the basis of invisible attributes, 2 to 4

other gains in ability

placing objects in given positions, from 33% to 75%

Torrance Test of Creative Thinking: fluency, 29-54
flexibility, 37 to 40
elaboration, 32 to 50

3. Demonstrated ability in pre-test of:

combining (XXII)5, conserving number, conserving solids, ordering colors

4. Demonstrated little or no ability or improvement:

ability to represent spatial relationships (25%)
representing objects (table XXII) 3,
horizontal orientation

JANE

Age 11, receptive and expressive impairment and bilateral sensori-neural hearing loss secondary to maternal rubella. IQ: WISC, 72. Low average visual motor organizational ability Bender Gestalt test indicates the presence of visual perceptual difficulties.

1. Demonstrated lack of ability on pre-test, ability on post-test in:

ordering colors

2. Demonstrated gain in ability as rated on scales of 1 to 5 points:

horizontal and vertical orientation, from 3 to 5 each
Teacher Rating Scale: ability to detect similarities
ability to associate new information, concentrate, retain information, solve problems, originate ideas

Also items 1-3, 7-9, in language development and items 22-26, 29, and 30 in attitudinal change

Other gains in ability:

objects in given positions, from 72% to 100%
Torrance test of Creative Thinking, fluency, from 35 to 55
flexibility, from 40 to 63
originality, from 40 to 50

3. Demonstrated ability in pre-test of:

grouping 3 objects on the basis of class or function
grouping 12 objects from an array
conserving numbers
ordering sticks
transposing a matrix
representing spatial relationships

4. Demonstrated little or no ability or improvement in:

conserving liquid
conserving solids

ELLEN

age 13, organic disorder of central origin, expressive with probable receptive components; mild to moderate diffuse cerebral dysfunction of paroxysmal type. IQ: 140, Goodenough Test; Bender Gestalt, well executed.

1. Demonstrated lack of ability on pre-test, ability on post-test in:

conserving solids

2. Demonstrated gain in ability on post-tests:

Torrance Test of Creative Thinking, fluency, from 44 to 52
flexibility, from 50 to 59
originality, from 44 to 50

placing 3 objects in given positions from 75% to 100%
representing spatial relationships (left-right,etc.) from 70% to 100%

other gains rated on scales of 1 to 5 points:

Teacher Rating Scale: ability to group on the basis of class or function, put objects in sequence, recognize that appearances may be deceiving, associate new information, concentrate, originate ideas
self-confidence, select names of objects, comprehend words and phrases, follow instructions, find the right word
art sensitivity and skill, from 3 to 4 (Table XXII)

3. Demonstrated ability in pre-test of:

conservation of liquid
conserving numbers
grouping 3 objects on the basis of class or function
grouping 12 objects from an array
ordering sticks
ordering colors
horizontal and vertical orientation
selecting and combining

4. Demonstrated little or no ability or improvement in:

transposing a matrix (is able to reconstruct matrix, scored 3, no change)

CAROL

age 14, receptive impairment, bilateral severe sensori-neural hearing loss (r 80 dB, L 82 dB) Vineland, IQ: 95; Nebraska, average IQ, Bender-Gestalt suggests possibility of neurological involvement.

1. Demonstrated lack of ability on pre-test, ability on post-test in:

   ordering sticks

2. Demonstrated gain in ability in:

   selecting, combining, representing objects or events
   horizontal and vertical orientation
   representing spatial relationships, from 75% to 100%
   Teacher Rating Scale: interest in learning, playfulness
   placing objects in given positions

3. Demonstrated ability on pre-test of:

   conserving number
   grouping 12 objects
   transposing matrix
   ordering colors
   representing objects or events

4. Demonstrated little or no ability or improvement in:

   conserving liquid, conserving clay
   grouping 3 objects
   art sensitivity or skill
   Torrance Test of Creative Thinking

DAISY

age 14, receptive and expressive impairment with sensori-neural hearing loss (L 79dB, R 75 dB). Merrill-Palmer; MA 6½ years, CA 7¼ years.

1. Demonstrated lack of ability on pre-test, ability on post-test in:

   grouping 3 objects
   conserving solids
   ordering sticks

2. Demonstrated gain in ability in:

   placing objects in given positions, from 33% to 100%
   horizontal orientation, from 3 to 5 points

vertical orientation, 2 to 3 points
selecting on basis of idea, from 3 to 5 (Table XX)
combining on basis of over-all coordination (Table XX)
Teacher Rating Scale: retaining information, solving problems, controling emotions
representing spatial relationships, from 75% to 100%

3. Demonstrated ability on pre tests of:

grouping 12 objects
conserving number
transposing matrix
ordering color

4. Demonstrated little or no ability or improvement in:

art sensitivity or skill
Torrance Test of Creative Thinking
ability to represent objects or events

SUE

age 13, receptive and expressive impairment with sensori-neural hearing loss (R 73dB, L 85 dB) "average" IQ: no test scores.

1. Demonstrated lack of Ability on Pre-test, ability on post-test in:

none

2. Demonstrated gain in ability in:

placing objects in given positions, from 60% to 100%
horizontal and vertical orientation, from 3 to 5
selecting, combining, representing, 1 to 5 (Table XX)
combining on basis of over-all coordination (Table XX)
Teacher Rating Scale: concentrating, retaining information, following instructions, finding right word

3. Demonstrated ability on pre-tests in:

grouping 3 objects, grouping 12 objects
conserving numbers
ordering sticks
transforming matrix
ordering colors

4. Demonstrated little or no ability or improvement in:

conserving liquid, conserving clay
Torrance Test of Creative Thinking
art sensitivity or skill

BURT

age 13, receptive and expressive impairment as well as hearing loss, with a level of 75 dB in his better ear.
IQ: 43 Stanford Binet, MA: 3 years 8 months, CA 9 years
PQ: 56 Merrill Palmer, MA: 4 years 2 months, CA 8 years 6 months
SQ: 59 Vineland, MA: 4 years 4 months, CA 8 years 6 months

Demonstrated lack of ability on pre-test, ability on post-test in

conserving liquid, conserving solids
selecting, from 1 to 5, Tables XX and XXII
combining, from 1 to 5, Tables XX and XXII
representing, from 1 to 5, Tables XX,XXII,XXIX.
art sensitivity and skill, from 1 to 5, Table XXIX

Demonstrated other gains in ability in

ordering matrix, from reproducing to transposing
placing objects in given positions, from 70% to 100%
horizontal orientation, from 3 to 5
Teacher Rating Scale: grouping on basis of invisible attributes, recognizing that appearances may be deceiving, associating new information with what he already knows and selecting named objects (from "almost never" to "fairly often, 1-4)
originating ideas or forms, joining readily in group

Demonstrated ability on pre-test in

conserving number, vertical orientation
ordering sticks, ordering colors
grouping 12 objects (unable to do so on post-test)

Demonstrated little or no ability or improvement in

grouping 3 objects, Torrance Test of Creative Thinking
representing spatial relationships: left-right from 0 to 3; before-behind, from 0 to 2; above-below, from 4 to 1; proportion, from 4 to 2.

DON

age 15, expressive impairment, hears and understands
IQ: 65 Nebraska scale. Bender Gestalt indicates neurological deficiency, poor visuo-motor coordination and performance

Demonstrated lack of ability on pre-test, ability on post-test in

conserving liquid, conserving solids
selecting, from 1 to 5, TableXXII
combining, from 1 to 5, Table XXII
placing objects in given positions, from 0 to 100%

Demonstrated other gains in ability in

horizontal orientation, from 4 to 5
selecting, from 3 to 5, Table XX
combining, from 4 to 5, Table XX
representing, froml to 3, Table XXII
art sensitivty and skill, from 3 to 5, Table XXIX

Demonstrated ability on pre-test in

conserving number
grouping 3 objects, grouping 12 objects
ordering sticks, colors, matrix
representing, Table XXIX

Demonstrated little or no ability in

representing, Table XX
Torrance Test of Creative Thinking

CHAPTER VI

SUMMARY AND OBSERVATIONS

The first objective of the project was to help an experimental group of children develop certain logical and mathematical ideas: conservation and the 3 basic structures from which the various branches of mathematics can be generated - grouping, ordering, and spatial orientation. The second objective was to develop procedures for teaching these ideas. The third objective was to develop procedures for evaluating cognitive abilities and disabilities.

The objectives were predicated on 3 assumptions: that children with language and hearing disabilities can use visuo-spatial abilities to form these ideas, that art procedures can be useful in teaching the ideas and evaluating the cognitive skills of children in general and language impaired children in particular, and that these procedures are compatible with the objectives of art education and art therapy. Emotional development was beyond the scope of this project.

The first term experimental group was a randomly selected 50% sample of the first 6 numerically ordered classes, with minor exceptions, at the School for Language and Hearing Impaired Children in New York City. The remaining children served as controls. There were 18 experimental children who attended one 40-minute art class a week for 11 weeks, from October through December, 1972. Their classroom teachers participated in weekly inservice workshops, and scored two of the pre-post tests at the end of the term. The second term experimental group (N 19) was a randomly selected 50% sample of 6 other classes. The children ranged in age between 8 and 15 years. Six teaching procedures and ten evaluating procedures were developed. A summary of the results follows:

CONSERVING

Ability to Conserve Liquid

In the pre-test, 15 experimental children and 14 control children demonstrated lack of ability. In the post-test, 11 experimental and 17 control children demonstrated lack of ability. Thus, 27% of the children who participated in the art program developed the ability to conserve liquid while none of the control children developed ability. The reason that 3 control children lost the ability is unclear, but as illustrated in the preceding chapters, inconsistency occurs frequently with these children.

Ability to Conserve Number

In the pre-test, 2 experimental and 1 control child demonstrated

lack of ability. In the post-test, no children demonstrated lack of ability, indicating the task was too easy to be useful.

Three additional measures of conservation, based on teaching and evaluating procedures developed during the first term, were added to the post-tests. Although they could provide only post-tests for the control children, they seem to offer useful information, as follows.

Ability to Conserve Solids

In the classroom pre-test, 15 experimental children demonstrated lack of ability to conserve amounts of clay. In the post-test, 9 experimental and 16 control children demonstrated lack of ability, suggesting that the teaching and a beneficial effect on 40% of the group.

Horizontal Orientation

In the classroom pre-test, 15 experimental children demonstrated lack of ability. In the post-test, 7 experimental and 12 control children demonstrated lack of ability, suggesting that 47% of the group developed ability.

Vertical Orientation

In the classroom pre-test, 13 experimental children demonstrated lack of ability. In the post-test 6 experimental and 15 control children demonstrated lack of ability, again showing a 54% improvement in the experimental group.

GROUPING

Ability to Group 3 Objects on the Basis of Class or Function

In the pre-test, 10 experimental and 10 control children demonstrated lack of ability. In the post-test, 6 experimental and 6 control children demonstrated lack of ability, suggesting that the teaching procedures had no specific value in this area.

Ability to Group 12 Objects from an Array

In the pre-test, 3 experimental and 4 control children demonstrated lack of ability. In the post-test, 3 experimental and 2 control children demonstrated lack of ability, indicating that the variable had no effect.

Three additional measures of ability to group were developed during the first term and added to the post-test. The ability was broken down into 3 components - selecting, combining, and representing - and evaluated on a scale of 1 to 5 points.

Ability to Select on the basis of class or function

In the pre-test, 7 experimental children demonstrated lack of ability

selecting on the basis of perceptible attributes, such as color or shape. In the post-test, 2 demonstrated lack of ability, an improvement of 70%. Six control children demonstrated lack of ability.

Ability to Combine on the basis of Over-all Coordination or Base line

In the pre-test, 5 experimental children demonstrated lack of ability, combining on the basis of proximity, distance, enclosure, etc., and producing fragmentary drawings. In the post-test, 1 demonstrated lack of ability, an 80% improvement. In the control group, 10 children demonstrated lack of ability.

Ability to Represent on the basis of Reconstruction or Tranformation

In the pre-test, 6 experimental children demonstrated lack of ability, representing on the basis of description, producing imitative, learned, impersonal drawings. In the post-test, none demonstrated lack of ability, an improvement of 100%. In the control group, 6 children demonstrated lack of ability.

Ability to Select, as Evaluated by a University Professor of Art

In their first drawings or paintings, 11 experimental children demonstrated lack of ability, selecting on the basis of perceptible attributes. In the drawings or paintings produced at mid-term or the end of the term, 1 child demonstrated lack of ability, a 90% improvement.

Ability to Combine as Evaluated by a University Professor of Art

In their first drawings or paintings, 6 children demonstrated lack of ability, producing fragmentary artwork. In their drawings or paintings produced at mid-term or the end of the term, none demonstrated lack of ability, an improvement of 100%.

ORDERING

Ability to Order a Series of Sticks

In the pre-test, 7 experimental and 11 control children demonstrated lack of ability to form a single dequence systematically. In the post-test, 2 experimental and 5 control children demonstrated lack of ability so that 80% of the experimental and only 55% of the control children developed ability.

Ability to Replace, Reconstruct, or Transpose a Matrix

In the pre-test, 8 experimental children demonstrated lack of ability to transpose, 4 demonstrated lack of ability to reconstruct.

and 1 demonstrated lack of ability to replace the objects. In the post-test, 5 demonstrated lack of ability to transpose, 1 demonstrated lack of ability to reconstruct, and none demonstrated lack of ability to replace.

In the pre-test, 10 control children demonstrated lack of ability to transpose, 6 demonstrated lack of ability to reconstruct, and none demonstrated lack of ability to replace. In the post test, 10 demonstrated lack of ability to transpose, 5 demonstrated lack of ability to reconstruct, and none demonstrated lack of ability to replace. The table below indicates the percentage of improvement and demonstrates that the teaching procedures were highly effective.

	Transpose		% of	Reconstruct		% of	Replace		% of
	Pre	Post	Improve.	Pre	Post	Improve.	Pre	Post	Improve.
Exper. Group	8	5	40%	4	1	75%	1	0	100%
Control Group	10	10	0	6	5	16%	0	0	--

Two additional measures of ordering were developed and added to the post-tests as follows:

Ability to Order a Series of Colors

In the classroom pre-test, 5 experimental children demonstrated lack of ability. In the post-test, 1 child demonstrated lack of ability, improvement of 80%. In the control group, 4 demonstrated lack of ability.

Ability to Place Objects in Given Positions

In the classroom pre-test, 9 experimental children demonstrated lack of ability. In the post-test, none demonstrated lack of ability, an improvement of 100%. In the control group, 5 children demonstrated lack of ability.

Ability to Represent Spatial Relationships

This measure was not added to the first term post-test although it was included in the second term pre-post test. Even though there were no scores for the control group, the resulsts are of interest. In the classroom pre-test, 12 of the 15 children present demonstrated lack of ability. In the post-test, the same da , 4 demonstrated lack of ability, an improvement of 66%.

TEACHER RATING SCALES

Language Development

More experimental children, as compared with controls, demon-

strated gain on a pre-post test basis in 2 of the 10 abilities under examination. Average scores of experimental children were 3.29 in the pre-test and 3.31 in the post-test. Average scores of the control children were 3.12 on the pre-test and 3.13 on the post-test.

Cognitive Ability

More experimental children as compared with controls, demonstrated gain on a pre=post test basis in 3 of the 10 abilities under examination. Average scores of experimental children were 3.07 in the pre-test and 3.24 in the post-test. Average scores of the control children were 2.73 in the pre-test and 2.94 on the post-test.

Attitudinal Change

More experimental children as compared with controls, demonstrated gain on a pre=post test basis in 2 of the 10 attitudes under examination. Average scores of experimental children were 3.75 in the pre-test and 3.78 in the post-test. Average scores of the control children were 2.73 on the pre-test and 2.94 on the post-test.

Mathematics, Reading, Language, Attitudes, Motor or Visuo-Spatial Skills

Experimental children, as compared with controls, demonstrated greater gains in all of the skills under consideration. They gained an average of 4.52 points while control children gained an average of 2.97 points between September, 1972, before the art program started, and May, 1973, 4 months after the progam ended. In mathematics, experimental children gained 19.5 points while control children gained 16 points; in reading, 15.5 points while controls gained 14 points; in language, 15.5 points while controls gained 9.5 points; in attitudes, 13 points while controls gained 7 points; in motor or visuo-spatial skill, 17 points while controls gained 7 points.

These findings seem to indicate that the gains which occurred did not become manifest immediately but became evident several months later after the program ended.

CREATIVE ABILITY

Torrance Test of Creative Thinking

More experimental children as compared with controls, evinced greater gain on a pre-post test basis in 3 of the 4 abilities under examination: fluency (15 experimental and 14 control), flexibility (12 experimental and 9 control), and elaboration (6 experimental and 5 control). Average scores of experimental children were 46.67 on the pre-test and 48.45 on the post-test. Average scores of control children were 43.52 on the pre-test and 46.67 on the post-test.

Evaluation by a University Professor of Art

Eleven of the 18 experimental children demonstrated gain in ability to represent, a gain of 63%. Initial drawings or painting

by 9 of the 11 children received the lowest score, 1 (descriptive, imitative, learned, impersonal). Three of their drawings or paintings produced at mid-term or the last art class received the median score, 3 (goes beyond description, elaborates, edits), while 6 drawings or paintings received the highest score, 5 (beyond restructuring, highly personal, imaginative). Thus 66% of the children initially receiving the lowest score, subsequently received the highest score.

Seven experimental children demonstrtated gain in ability to represent attitudes, their initial work receiving no score. Two of their subsequent works represented villains, victims, weapons, injury, etc., 7 works represented heroes, heroines, escapes, romances, etc., 9 represented solitary or isolated people, 4 represented omissions or distortions, and 6 represented "fine expression of a central idea".

Thirteen experimental children demonstrtated gain in ability to represent thoughts and feelings through art forms. Five children whose initial work received the lowest score 1 (commonplace form or content), subsequently received the highest score, 5(highly skillful, exploratory, or sensitive to art qualities).

Evaluation by an Art Therapist-Painter

Eleven experimental children demonstrtated gain in ability to represent. The initial drawings or paintings of 6 children were scored 1 or 2 (descriptive or slighly above), their subsequent work scored 5.

Six children demonstrated gain in ability to represent attitudes, their initial works receiving no score. Three of their subsequent works represented solitary or isolated people, 8 represented villains, etc., 6 represented heroes, etc.,8 represented omissions or distortions, and 13 represented a "fine expression of a central idea".

Twelve children demonstrated gain in ability to represent through art forms. Six children whose initial work received the lowest score subsequently received the highest score for skill, exploration, and sensitivity.

It is interesting to note that the child who received the unusually high score of 100 in the Torrance test of Creative Thinking, (Eve) received only moderate scores from the art specialists, between 1 and 3 from the art therapist-painter, and between 2 and 4 from the art educator.

OBSERVATIONS

In the pilot study, more children demonstrated gain in ability to conserve and to group that in the project. In the pilot study, the children attended 15 weekly art classes while in the project, they attended only 11. Although the project had been planned for

20 weeks of instruction each term, it had been necessary to spend 9 weeks of the first term developing and administering the tests required by the evaluation design. If more than 11 periods of instruction could have been provided, the results might well have been more decisive.

To summarize, there were 35 evaluations of ability, 20 of which were evaluated on a pre-post ~~test~~ basis for both experimental and control groups. The remaining 15 evaluations were developed during the term and consequently only the experimental groups had two testing periods.

Twenty-six of the 35 evaluations seem to indicate successful changes for the experimental group. In 20 evaluations, at least 40% of the experimental children succeeded. In ability to conserve solids, 6 out of 15 experimental children succeeded -40%. In horizontal orientation, 8 out of 15 succeeded -47%. In vertical orientation, 7 out of 13 succeeded- 54%. In ability to group: 5 out of 7 succeeded in selecting - 70%, 4 out of 5 succeeded in combining - 80%, 6 out of 6 succeeded in representing - 100%. As evaluated by the university professor of art: 10 out of 11 succeeded in selecting - 90%, and 6 out of 6 in combining - 100%. In ability to order, they succeeded as follows: series of sticks, 5 out of 7 -80%; series of colors, 4 out of 5 - 80%; reconstructing a matrix, 3 out of 4 - 75%; transposing a matrix, 3 out of 8 - 40%. In spatial orientation, they succeeded as follows: placing objects in given positions, 9 out of 9 -100%; representing spatial relationships, 8 out of 12 - 67%; representing objects, 11 out of 18 - 61% as evaluated by the art educator and art therapist-painter. In art skills and values, 72% succeeded, according to the art educator, and 66% succeeded, according to the art therapist-painter.

Based on the evaluations presented in the report, the following observations are offered:

1. art procedures can be useful in teaching ideas of conservation, grouping, ordering, and spatial orientation.

2. art procedures can be useful in evaluating cognitive and visuo-spatial abilities and disabilities

3. art educators can go beyond art <u>per se</u> without neglecting the development of art skills and values

These observations cannot be considered conclusive since they are based on a small number of subjects. As tentative conclusions, they are offered as the basis for, and encouragement of, further investigation.

REFERENCE

Arnheim, Rudolf, Visual Thinking, University of California Press, 1969

Bruner, Jerome, et al, Studies in Cognitive Growth, John Wiley & Sons, 1966

Elkind, David, et al, Studies in Cognitive Development, Oxford University Press, 1969

Furth, Hans, Thinking Without Language, The Free Press, N.Y., 1966

Jakobson, Roman, "Linguistic Typology of Aphasic Impairments", Disorders of Language, CIBA Foundation Symposium, AVS deReuck and Maeve O'Connor, eds. Little Brown and Co., Boston, 1964.

Masland, Richard L., M.D., "Brain Mechanisms Underlying the Language Function", Human Communication and its Disorders, National Institutes of Health, Public Health Service, U.S. Department of Health, Education and Welfare, 1969

Piaget, Jean and Barbel Inhelder, The Child's Conception of Space, W.W. Norton and Co., New York 1967

Genetic Epistemology, Columbia University Press, 1970

Mental Imagery in the Child, Basic Books, Inc.,NY 1971

Sinclair-de-Swart, Hermina, "Developmental Psycholinguistics", Studies in Cognitive Growth, op. cit.

Strauss, Alfred A. and Newell C. Kephart, Psychopathology and Education of the Brain-Injured Child, Grune and Stratton, 1955

Silver, Rawley A., The Role of Art in the Conceptual Thinking Adjustment and Aptitudes of Deaf and Aphasic Children, Ed.D. Project Report, Columbia University 1966

A Demonstration Project in Art Education for Deaf and Hard of Hearing Children and Adults, U.S. Office of Education Report, 1967, ERIC No. Ed. 013 009.

TABLE I: INSTRUCTIONS FOR ADMINISTERING FIRST TERM PRE-TEST OF COGNITIVE SKILLS

A. CONSERVATION OF LIQUID
based on experiments by Jean Piaget and Barbel Inhelder (1971 p.259)

1. Show the child two glasses, A1 and A2, of equal size and shape, and a taller, thinner glass, B. As he watches, pour the tinted water into A1 and A2 giving A2 less water. Then pour contents of A1 into glass B, and ask him if there is the same quantity to drink in B as in A2.

2. Pour the contents of B back into A1. Then pourcontents of A2 into B and ask him if there is the same quantity to drink in A1 as in B.

3. Pour contents of B back into A2. Ask him to give A1 and A2 the same amounts of water by pouring back and forth until he is satisfied that they have the same quantity. Then ask him to pour the water from A1 into B, and ask if there would be the same quantity to drink in B as in A2.

B. CONSERVATION OF NUMBER
based on experiments by Jean Piaget (1970 p.34)

1. Show the child 8 red discs in a row and a pile of 12 black discs. Ask him to make a row of the same number of black discs.

2. Line up 8 black discs below the row of red discs but spreading them out so that they make a longer line. Count the red discs aloud, then ask him how many are in the black row.

C. GROUPING THREE OBJECTS
based on test by Patricia M. Greenfield (Bruner, p.289-318)

Present three drawings: red car, blue hat, blue bicycle (Set A). Ask child to select "the two pictures that are almost alike". If he does not seem to understand, explain that the bicycle and hat are both blue, the hat and car have the same shape, and the car and bicycle can both be driven.

Then presentthe yellow clock, red apple, and yellow bananas (Set B) and repeat questions. Score first choice reply.

D. GROUPING OBJECTS FROM AN ARRAY
based in test by Joan Rigney Hornsby (Bruner, pp. 79-85)

Present array of 12 drawings (Set C) and ask child to select pictures that are alike in some way. He may take as many as he wishes. After he has made his choices, ask him why they are alike.

TABLE I (Cont'd)

E. ORDERING A SERIES
based on a test by Jean Piaget (Piaget, 1970, pp. 29-30)

Present the ten sticks in a pile and ask the child to put them in order from the shortest to the longest.

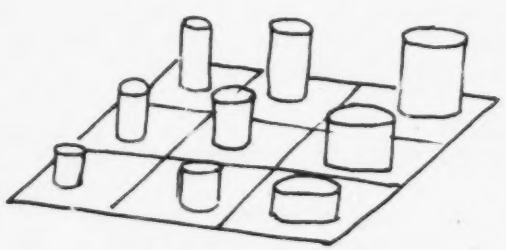
F. ORDER A MATRIX
based on a test by Jerome S. Bruner and Helen J. Kenney (Bruner, pp. 156-167)

1. Present the 9 cylinders arranged on the 3 by 3 matrix as indicated below. Remove first 1 cylinder, then 2, and then 3 at a time, and ask the child to replace them.

2. Ask him how the cylinders are alike and how they differ.

3. Scramble the cylinders and ask him to build "something like what was there before".

4. Scramble the cylinders once more, but this time place the cylinder that was formerly in the southwest corner of the grid (the shortest, thinnest cylinder) in the southeast corner. Ask him again whether he can make something like what was there before, leaving the 1 cylinder where placed by the examiner.



Jean Piaget and Barbel Inhelder, Mental Imagery in the Child, Basic Books, Inc., NY 1971

Jerome S. Bruner, et. al, Studies in Cognitive Growth, John Wiley and Sons, Inc., New York, 1966

Jean Piaget and Barbel Inhelder, The Child's Conception of Space, W. W. Norton and Company, Inc., New York 1967

Jean Piaget, Genetic Epistemology, Columbia University Press, New York, 1970

TABLE II: INSTRUMENT FOR SCORING RESPONSES TO FIRST TERM PRETEST OF COGNITIVE SKILLS

name class age date

A. CONSERVATION OF LIQUID
1.___ says they are different
2.___ says they are different
3.___ says theyare the same when the amounts are, in fact, the same

comment

B. CONSERVATION OF NUMBER
4.___ makes line about as long but disregards number
5.___ puts out 8 black discs
6.___ says they are the same when, in fact, they are different
7.___ says there are 8 discs in black row
8.___ says the rows are the same
9.___ says the rows are different
10.___ says there are more discs in black row

comment

C. GROUPING THREE OBJECTS
11.___ selects clock and banana, on the basis of color
12.___ selects clock and apple, on the basis of shape
13.___ selects apple and banana, on the basis of function or class
14.___ uses concrete language, such as "yellow" or "round"
15.___ uses functional language, such as "to eat"
16.___ uses abstract language, such as "food"

comment

D. GROUPING OBJECTS FROM AN ARRAY
17.___ selects __ pictures on the basis of perceptual attributes
18.___ selects __ pictures on the basis of functional attributes
19.___ verbal response is based on perceptual attributes
20.___ verbal response is based on functional attributes

comment

E. ORDERING A SERIES
21.___ forms single series through trialand error
22.___ forms single series using systematic approach, such as starting with smallest, next smallest, etc.

comment

F. ORDERING A MATRIX
23.___ can replace objects
24.___ reproduce matrix in its original position
25.___ can transpose matrix
26.___ verbal response is based on differences
27.___ verbal response is based on similarities
28.___ uses global language, such as "big" and "little"
29.___ uses dimensional language, such as "tall" and"short"
30.___ uses confounded language, such as "tall" and "little"

comment

III: INSTRUCTIONS FOR ADMINISTERING ADDITIONS TO FIRST TERM POST-TEST OF COGNITIVE SKILLS

G. CONSERVATION OF CLAY
based on experiment by Anne Mackknnon Sonstroem (Brunner, p.208)

Show the child two balls of plasticine about an inch in diameter. Ask him if they have the same amounts of clay. If he says no, ask him to make them the same by taking clay from one and adding it to the other.

When he is satisfied that they are the same, roll one of the balls into a "hotdog", then ask, "Is there more clay in here (pointing) or in here?"

H. HORIZONTAL AND VERTICAL ORIENTATION
based on test by Jean Piaget and Barbel Inhelder (1967, p.381)

Show the child the bottle with straight sides, ¾ filled with water, tilting it briefly long enough to attract his attention to the surface of the water.

Present form H, the outline drawings of 4 bottles in different positions: and a mountain with house and tree on top.

1. Ask him to draw the way the water would look in the bottles
2. Ask him to draw a house and tree on the mountain slope

I. ORDERING COLOR CARDS
based on teaching procedures in the project

Present the 8 cards in a disordered pile, and ask the child to put them in order from the lightest tint to the darkest shade.

J. PLACING BLOCKS IN GIVEN POSITIONS
based on teaching procedure in the project

Place the three blocks directly above their outline drawings on Form J and give child the identical blocks and an unmarked sheet of paper.

Ask him to reconstruct the arrangement in the same way on his paper. When he has arranged them to his satisfaction, draw an outline around each of his blocks. Then superimpose the two sheets of paper and hold up to the light.

TABLE IV: INSTRUMENT FOR SCORING RESPONSES TO FIRST TERM POST-TEST FOR COGNITIVE SKILLS

name class age date

A. CONSERVATION OF LIQUID

1.___ says they are different when amounts appear different and are different
2.___ says theyare different when they appear the same but are different
3.___ says they are the same when the amounts appear different but are, in fact, the same

comment

B. CONSERVATION OF NUMBER

4.___ makes line about as long but disregards number
5.___ puts out 8 black discs
6.___ says they are the same when they are, in fact, different
7.___ says there are 8 discs in black row
8.___ says the rows are the same
9.___ says the rows are different
10.___ says there are more discs in black row

comment

C. GROUPING THREE OBJECTS

11.___ selects clock and banana
12.___ selects clock and apple
13.___ selects apple and banana
14.___ uses concrete language, such as "yellow" or "round"
15.___ uses functional language, such as "to eat"
16.___ uses abstract language, such as "food"

comment

D. GROUPING OBJECTS FROM AN ARRAY

17.___ selects __ pictures on the basis of perceptual attributes
18.___ selects __ pictures on the basis of functional attributes
19.___ verbal response is based on perceptual attributes
20.___ verbal response is based on functional attributes

comment

E, ORDERING A SERIES

21.___ forms single series through trial and error
22.___ forms single series using systematic approach, such as starting with smallest, next smallest, etc.

comment

F. ORDERING A MATRIX

23.___ can replace objects
24.___ reproduce matrix in its original position
25.___ can transpose matrix
26.___ verbal response is based on differences
27.___ verbal response is based on similarities
28.___ uses global language, such as "big" and "little"
29.___ uses dimensional language, such as "tall" and "short"
30.___ uses confounded language, such as "tall" and "little"

comment

G. CONSERVATION OF CLAY

31.___ says the ball has more clay, or the hotdog has more clay
32.___ says the ball and the hotdog have the same amounts

comments

H. HORIZONTAL AND VERTICAL ORIENTATION

33.___ represents water with scribbles or round blot
34.___ represents water with line parallel to base of bottle
35.___ represents water with oblique line in tilted bottle
36.___ represents water with almost horizontal line in tilted bottle (while water in other bottles appears horizontal)
37.___ represents water in all bottles as horizontal
38.___ draws house or tree within or parallel to mountain
39.___ draws house or tree perpendicular to mountain slope
40.___ draws house or tree between perpendicular and vertical
41.___ draws house or tree vertical but without apparent support
42.___ draws house or tree vertical with apparent support

comment

I. ORDERING COLOR CARDS

43.___ places 3 or more cards in series but does not form correct single series
44.___ forms single series correctly through trial and error
45.___ forms single series correctly systematically, starting with one card and working up or down from it

comment

J. PLACING OBJECTS IN GIVEN POSITIONS

(in order to evaluate, superimpose outlines and hold them up to light)

46.___ block outlines overlap 25% or less
47.___ block outlines overlap about 50%
48.___ block outlines overlap 75% or more

TABLE V: Drawing Test of Ability to Select, Combine, and Represent

Each child in the class is presented with a sheet of drawing paper 9 x 12" and a pencil. Eight ink drawings of familiar subjects are displayed on the blackboard: a girl, boy, dog, telephone, television set, bed, refrigerator, table and lamp.

The children are asked to draw a picture that tells a story, using as few or many of the model drawings as they like. They are asked not to copy the models but to make pictures of their own.

Results are scored by classroom teachers using the following instrument:

In this drawing or painting, the child apparently

A. SELECTED PICTORIAL ELEMENTS ON THE BASIS OF
   1.____perceptual attributes (colors, shapes, etc.)
   3.____functional attributes (what subjects do, what can be done to them)
   5.____an idea (logical or illogical, storytelling or abstract)

B. COMBINED ELEMENTS ON THE BASIS OF
   1.____proximity, distance, enclosure, etc. (fragmentary)
   3.____base line or bottom of paper
   5.____a unified whole, over-all coordination, attention given to whole paper and/or environment of subjects)

C. REPRESENTED OBJECTS OR EVENTS ON THE BASIS OF
   1.____description (imitative, learned, impersonal)
   3.____restructuring (goes beyond description to elaborate or edit an experience)
   5.____transformation (goes beyond restructuring, highly personal, interpretation, imaginative, inventive)

D. USED LANGUAGE (__spontaneous __solicited __written __oral)
   1.____descriptive (simply describes what is visible.)
   3.____amplifying (description of objects amplifying what is vislble)
   5.____transforming (an idea not apparent without explanation, symbolic or abstract meaning)

TABLE VI: DRAWING TEST OF ABILITY TO REPRESENT SPATIAL RELATIONSHIPS AND INSTRUCTIONS FOR SCORING RESPONSES

The children are presented with an arrangement of four objects: three cylinders of different heights, widths, and colors, and a wooden "egg". The arrangement, on a table in front of the room, is placed on a sheet of paper 9 x 12", with another sheet of paper serving as back-drop, supported by the wall. Outlines of the objects are traced with pencil so that the arrangement can be duplicated.

Each child is given a sheet of drawing paper 9 x 12", pencil, and yellow, black, and green crayons. Then the teacher makes a quick sketch of the arrangement and asks the children to draw it from observation.

INSTRUCTIONS FOR SCORING:

Please score on the basis of 1 to 4 points for number of correct representations, as follows:

1. left-right relationships: when an object is shown correctly to the left or right of its neighbors, judging by the shapes and colors of the model drawing. If an object is misplaced, it is rated zero.

2. before-behind relationships: when an object is shown correctly in the foreground or background of the base plane in relation to its neighbors. If an object is on or above the "horizon", it is rated zero.

3. above-below relationships: when an object is shown correctly relative to the "horizon", a line marking the back of the base plane and the base of the back plane. If there is no horizon line, or if an object is on or above it, it is rated zero.

4. proportional relationships: when an object is shown correctly in size andshape in relation to its neighbors.

TABLE VII: INSTRUMENT FOR SCORING EVALUATION OF ART WORK BY ART THERAPIST-PAINTER, AND PROFESSOR OF ART

To be filled in after evaluation:

_____
child's name

_____
Identifying number date

_____
subject matter, if any

IN THIS DRAWING OR PAINTING, THE CHILD SEEMS TO HAVE ORGANIZED HIS EXPERIENCES BY:

_____
structuring, if any

A. SELECTING IMAGES ON THE BASIS OF
   1.___ perceptible attributes (appearance, colors, shape, etc.)
   3.___ functional attributes (what subjects do, what can be done to them)
   5.___ an idea (Logical or illogical, storytelling or abstract)

B. COMBINING IMAGES ON THE BASIS OF
   1.___ proximity, distance, enclosure (fragmentary)
   3.___ base line or bottom of paper
   5.___ over-all coordination, attention given to whole paper

C. COMBINING LANGUAGE WITH IMAGES ON THE BASIS OF
   1.___ description
   3.___ amplification
   5.___ transformation (abstract or symbolic meaning)

D. REPRESENTING OBJECTS OR EVENTS ON THE BASIS OF
   1.___ description (imitative, learned, impersonal)
   3.___ restructuring (goes beyond description, elaborates or edits)
   5.___ transformation (beyond restructuring, highly personal, imaginative)

E. REPRESENTING ATTITUDES ON THE BASIS OF
   1.___ solitary or isolated people or animals
   2.___ villains, victims, weapons, danger, injury or threat of injury
   3.___ heroes, heroines, romance, escape or happy occasion
   4.___ omissions or distortions (size, placement, reality)
   5.___ line or brush quality (vague, stabbing, heavy, etc.)
   6.___ fine expression of a central idea

F. REPRESENTING THOUGHTS AND FEELINGS THROUGH ART FORMS
   1.___ commonplace form or content
   3.___ moderately skillful, exploratory, or sensitive to art qualities
   5.___ highly skillful, exploratory, or sensitive, suggests much care or enjoyment

TABLE VIII: TEACHER RATING SCALE

CLASS NAME DATE

IS (S)HE ABLE TO:	almost never	on rare occa-sions	some-times	fairly often	very often
1. select named objects					
2. comprehend words and phrases					
3. follow instructions					
4. find the right words					
5. use nouns, synonyms, antonyms					
6. combine words into sentences					
7. use connective words, prounouns, adjectives, adverbs					
8. sequence events, tell stories					
9. explain his thoughts or ideas					
10. discuss hypothetical questions					
IN NON-VERBAL ACTIVITIES, DOES (S)HE					
11. detect similarities between objects					
12. group objects on the basis of invisible attributes such as class or function					
13. put objects in sequence such as size or weight					
14. recognize that appearances may be deceiving (knows that spreading out a row of pebbles does not increase the number, for example)					
15. associate new information with what he knows, incorporate and make use of it					
16. concentrate for more than 5 minutes					
17. retain information and carry a task through to completion					
18. solve problems					
19. engage in imaginary play					
20. originate ideas or forms					
DOES (S)HE TEND TO					
21. work independently without asking for help or direction					
22. control emotions (does not cry easily or hit, shove, fight)					
23. tolerate frustration					
24. join readily in group activities (not					
25. particularly shy)					
26. cooperate with otherchildren					
27. be interested in learning language					
28. be interested in learning generally					
29. be playful, humorous					
30. have self-confidence, self-esteem					

TABLE IX: SECOND TERM TEST OF COGNITIVE SKILLS - Instructions for Administering Pre-Test (January 1973) and Post-Test June 1973 (scheduled)

A. CONSERVATION OF LIQUID
based on experiments by Piaget and Inhelder, 1971, p.259

1. Show the child two glasses, A1 and A2, of equal size and shape, and a taller, thinner glass, B. As he watches, pour the tinted water into A1 and A2, giving A2 less water. Then pour contents of A1 into glass B. Ask child if there is the same quantity of water to drink in B as in A2.

2. Pour the contents of B back into A1. Then pour contents of A2 into B. Ask if there is the same quantity to drink in A1 as in B.

3. Pour contents of B into A2. Ask child to give A1 and A2 the same amounts of water, pouring back and forth until he is satisfied that they have the same quantity. Then ask him to pour the water from A1 into B. Ask if there would be the same quantity to drink in B as in A2.

B. CONSERVATION OF CLAY
based on experiment by Anne MacKinnon Sonstroem (Bruner,1966,p.208)

Show child two balls of plasticine about an inch in diameter and ask if they have the same amounts of clay. If he says no, ask him to make them the same by taking clay from one and adding it to the other.

When he is satisfied that they are the same, ask him to roll one of the balls into a "hotdog". Then ask, "Is there more clay here in the ball, or is there more clay here in the hotdog, or are they the same?"

C. HORIZONTAL AND VERTICAL ORIENTATION
based on experiments by Piaget and Inhelder, 1967, p.381

Show the child a bottle with straight sides ¾ filled with water, tilting it briefly just long enough to attract his attention to the surface of the water, but do not let him study or copy it.

Present the outline drawings of bottles in different positions, and of a mountain. Ask him to draw the positions water will assume in the Bottles, and to draw a house and a tree on the mountain slope.

D. GROUPING THREE OBJECTS
based on an experiment by Patricia M. Greenfield(Bruner, 1966,p.289)

Show the 3 cards with drawings of red car, blue bicycle, and blue helmet. Ask the child to select "the two pictures that are the most the same." After he has made his choice, ask him why they are the most the same. If he does not seem to understand, explain that the bicycle and helmet are both blue, the helmet and car have the same shape, and the car and the bicycle can both be driven.

Then present the yellow clock, red apple, and yellow banana and repeat the questions without explanations. Score his first reply.

E. GROUPING OBJECTS FROM AN ARRAY
adapted from an experiment by Joan Rigney Hornsby (Bruner,1966,p.79)

Show the 12 cards with drawings of objects and ask the child to select pictures that are alike in some way. He may take as many as he wishes. After he has made his choices, ask him why they are alike.

F. MATCHING AN ARRANGEMENT OF TOY ANIMALS
adapted from an experiment by Piaget and Inhelder, 1967, p.427

Place the 4 prehistoric animals on their outline drawings. Ask the child to selectthe same animals from a pile of animals and arrange them in the same way on his sheet of paper. Outline his animals using pens of the same color.

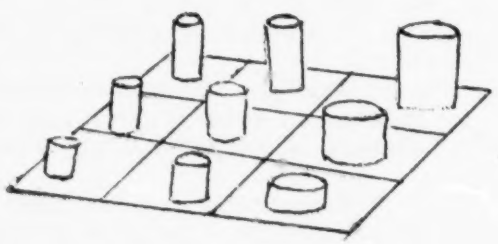
G. ORDERING A SERIES OF STICKS
based on an experiment by Piaget, 1970, p.29

Present the 10 sticks in a pile and ask the child to put them in order from the smallest to the longest. If he does not seem to understand, place the first and last stick for him.

H. ORDERING A MATRIX
based on an experiment by Bruner and Helen J. Kenney (Bruner,1966,p.156)

Show the child the 9 cylinders arranged on the 3 x 3 matrix. Remove 1 cylinder, then 2, then 3 at a time, askingthe child to replace them.

Scramble the cylinders and ask him to build "something like what was there before'"



Scramble them again, but this time, place the shortest, thinnest cylinder that was formerly in one front corner, in the other front corner. Again ask him to build something like what was there before, but leaving the cylinder where you placed it.

I. ORDERING A SERIES OF COLORS
based on a program experiment

Show the child the 6 cards in a disordered pile, and ask him to put them in order from the lightest tint to the darkest shade.

J. PLACING BLOCKS IN GIVEN POSITIONS

Present the 3 blocks over their outlines, and ask the child to place his blocks in the same way on his sheet of paper. Then draw outlines around his arrangement.

TABLE X: INSTRUMENT FOR SCORING SECOND TERM TEST OF COGNITIVE SKILLS

name class age date

A. CONSERVATION OF LIQUID

1.___ says they are different when amounts appear different and are different

2.___ says they are different when they appear the same but are different

3.___ says they are the same when the amounts appear different but are, in fact, the same

comment

B. CONSERVATION OF CLAY

4.___ says the ball and hot dog have the same amount of clay

comment

C. HORIZONTAL AND VERTICAL ORIENTATION

5.___ represents water with line parallel to base of bottle

6.___ represents water in tilted bottle with oblique line

7.___ represents water as horizontal

8.___ draws house perpendicular to mountain slope

9.___ draws house vertica' but without apparent support

10.___ draws house vertical with apparent support

comment

D. GROUPING THREE OBJECTS

11.___ selects clock and banana

12.___ selects clock and apple

13.___ selects apple and banana

comment

E. GROUPING OBJECTS FROM AN ARRAY

14.___ selects __ pictures on the basis of perceptual attributes

15.___ selects __ pictures on the basis of functional attributes

comment

F. MATCHING AN ARRANGEMENT OF TOY ANIMALS

16.___ animals correspond in number

17.___ animals correspond in color

18.___ animals correspond in species

19.___ animals correspond in relationship to other animals (left-right; before-behind)

20.___ animals correspond in relationship to edges of paper (angles and distances)

comment

G. ORDERING A SERIES OF STICKS

21.___ puts 3 or more in sequence or forms 2 series
22.___ forms single series correctly, through trial and error
23.___ forms single series correctly, using systematic approach

_____
comment

H. ORDERING A MATRIX

24.___ can replace cylinders
25.___ can reproduce matrix
26.___ can transpose matrix

_____
comment

I. ORDERING A SERIES OF COLORS

27.___ puts 3 or more in sequence, or forms 2 series
28.___ forms single series correctly, through trialand error
29.___ forms single series correctly, using systematic approach
30.___ uses dimensional language

_____
comment

J. PLACING BLOCKS IN GIVEN POSITIONS

31.___ blocks overlap at least 75% on the average

_____
comment

TABLE XI: ADDITION TO SECOND TERM TEST OF COGNITIVE SKILLS
INSTRUCTIONS FOR ADMINISTERING

K. CONSERVATION OF LENTILS

Present the lentils in the two tall jars and ask the child if they are the same. If he answers yes, pour the contents of one jar into the shallow dish.

Ask him, "Is there more here or here?" (pointing)

L. CONSERVATION OF TINTED WATER

Present the two tall glasses of water 3/4 full and ask if they are the same. If the child answers, yes, pour the contents of one glass in the shallow dish.

Ask, "Is there more here or here?" (pointing)

M. CONSERVATION OF NUMBER (Piaget, 1970, p. 34)

Show the child the 8 red discs and the pile of black discs. Ask him to put out the same number of black discs as there are red discs.

Then line up 8 black discs below the red line so that they form a longer line. Count the red discs aloud, then ask how many are in black row.

N. ORDERING A SERIES OF CIRCLES

Present the nine red circles, and ask the child to put them in order from smallest to largest.

O. ORDERING A SERIES OF TRIANGLES

Present the 9 green triangles, and ask the child to put them in order from smallest to largest.

P. ORDERING A SERIES OF TRIANGLES IN TINTS AND SHADES OF RED

Present the 8 triangles and ask the child to put them in order from lightest to darkest.

Q. ORDERING A SERIES OF PEBBLES

Present the 10 pebbles, and ask the child to put them in order from smallest to largest.

R. ORDERING A SERIES OF FIVE BARRELS

Show the child the barrels and ask him to place them in order from smallest to largest.

S. ORDERING A SERIES OF HEXAGONS

Show the child the hexagons and ask him to place them in order from smallestto largest.

T. DOUBLE CLASSIFICATION (Piaget, 1970, p.36)

Show the child the paper cut-outs of 5 people, 5 apples, and 5 trees in 5 colors. Ask him to put them together, the red person in correspondence with the red tree and the red apples, the green person in correspondence with the green tree and green apple, etc.

TABLE XII: INSTRUMENT FOR SCORING ADDITIONS TO SECOND TERM TEST OF COGNITIVE SKILLS

K. CONSERVATION OF LENTILS
31.___ says they are the same
32.___ says there were more in the taller container
33.___ says there was less in the taller container

L. CONSERVATION OF TINTED WATER
34.___ says it is the same
35.___ says it is more
36.___ says it is less

M. CONSERVATION OF NUMBER
37.___ makes line about as long but disregards number
38.___ puts out 8 black discs
39.___ says they are the same when, in fact, they are different
40.___ says there are 8 discs in black row
41.___ says the rows are the same
42.___ says the rows are different
43.___ says there are more discs in black row

N. ORDERING CIRCLES
44.___ puts 3 or more in sequence or forms 2 series
45.___ forms single series correctly through trial and error
46.___ forms single series correctly using systematic approach

O. ORDERING TRIANGLES
47.___ puts 3 or more in sequence, or forms 2 series
48.___ forms single series correctly, through trial and error
49.___ forms single series correctly, using systematic approach

P. ORDERING TRIANGLES IN TINTS AND SHADES
50.___ puts 3 or more in sequence or forms 2 series
51.___ forms single series correctly through trial and error
52.___ forms single series correctly, using systematic approach

Q. ORDERING PEBBLES
53.___ puts 3 or more in sequence or forms 2 series
54.___ forms single series correctly through trial and error
55.___ forms single series correctly using systematic approach

R. ORDERING BARRELS
56.___ puts 3 or more in sequence or forms 2 series
57.___ forms single series correctly through trial and error
58.___ forms single series correctly using systematic approach

S. ORDERING HEXAGONS
59.___ puts 3 or more in sequence or forms 2 series
60.___ forms single series correctly through trial and error
61.___ forms single series correctly using systematic approach

T. DOUBLE CLASSIFICATION
62.___ puts all objects together correctly; if not, please describe in detail, giving numbers and colors of pieces put together

TABLE XIII: RESULTS OF FIRST TERM PRE-TEST OF COGNITIVE SKILLS
SEPTEMBER - OCTOBER 1972

EXPERIMENTAL GROUP	CONSERVING										GROUPING										SEQUENTIAL ORDERING									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Daisy, 13 E-R	x	x			x		x	x				x		x				x		x			x	x	x	x		x		
Sue, 13 E-R	x	x			x		x	x					x			x		x		x		x	x	x	x	x		x		
Carol, 14 R	x	x			x		x	x				x		x				x		x			x	x	x	x		x		
Tom, 14 E-R	x	x	x		x		x	x				x		x				x		x		x	x	x	x		x			x
Burt 13 E-R	x	x			x		x	x				x		x				x		x		x	x	x		x		x		
Don, 15 E	x	x			x		x	x					x		x			x		x		x	x	x	x	x				x
Dan, 15 E	x	x			x		x	x			x			x				x		x		x	x	x	x	x		x		
Elmer, 12E	x	x			x		x	x					x		x			x		x		x	x	x	x	x		x		
EVe, 13 E-R	x	x			x		x	x			x			x			x		x		x		x			x		x		
Betty, 12R	x	x		x	x		x	x			x			x				x		x		x	x	x	x	x		x		
Jane, 11 E-R	x	x			x		x	x					x		x			x		x		x	x	x	x	x		x		
Ellen 12 E-R	x	x	x		x			x					x		x			x		x		x	x	x		x		x		
Roy 12E	x	x			x		x	x			x			x				x				x	x	x		x		x		
Rick, 12 E-R	x	x	x		x		x	x			x		x	x	x			x		x		x	x	x	x	x		x		
Ruben, 11 R	x	x			x		x	x			x			x			x		x		x									
Victor, 8 R	x	x			x		x	x					x		x			x		x	x		x	x				x		
David, 9 E-R	x	x		x						x			x			x		x		x			x							
Ruth, 9 E-R	x	x		x				x			x			x			x				x		x							

*x = ~~demonstrated ability~~, as scored in Table II, page 61
affirmative response

TABLE XIV: RESULTS OF FIRST TERM POST-TEST OF COGNITIVE SKILLS *
January 1973

EXPERIMENTAL GROUP	CONSERVING										GROUPING										SEQUENTIAL ORDERING									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Daisy, 13 E-R	x				x		x						x		x			x		x	x	x	x	x		x				
Sue, 13 E-R	x	x			x		x						x		x			x		x	x	x	x	x				x		
Carol, 14 R	x	x			x		x					x		x				x		x	x	x	x	x				x		
Tom, 14 E-R	x		x		x		x					x		x				x		x	x	x	x	x				x		
Bob, 13 E-R	x	x	x		x		x					x					x		x		x	x	x	x	x				x		
Don, 15 E	x	x	x		x		x						x		x			x		x	x	x	x	x				x	x	
Dan, 15 E	x	x			x		x						x		x			x		x	x	x	x	x				x		
Elmer, 12 E	x	x			x		x						x		x			x		x	x	x	x	x				x		
Eve, 13 E-R	x	x			x		x						x		x		x		x		x	x	x	x				x		
Betty, 12R	x	x	x		x		x					x		x				x		x	x	x	x	x				x		
Jane, 11 E-R	x	x			x		x						x		x			x		x	x	x	x	x				x		
Ellen, 12 E-R	x	x	x		x		x						x		x			x		x	x	x	x					x		
Roy 12 E	x	x			x		x				x			x			x		x		x	x	x							
Rick, 12 E-R	x	x	x		x		x						x		x	x		x		x	x	x	x	x	x			x		
Ruben, 11 R	x	x	x		x		x						x		x			x		x	x	x	x	x	x			x		
Victor, 8 R	x	x			x		x						x		x			x		x		x	x					x		
David, 9 E-R	x				x		x						x		x			x		x	x	x	x				x			
Ruth, 9 E-R	x	x			x		x				x			x			x	x	x	x		x					x			

* x = ~~demonstrated ability~~, as scored in Table IV, page 63
affirmative response

TABLE XV. RESULTS OF FIRST TERM PRE TEST FOR COGNITIVE SKILLS
September-October 1972

CONTROL GROUP	CONSERVING										GROUPING										SEQUENTIAL ORDERING									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Dotty, 15	x	x			x		x	x				x		x				x		x		x	x	x		x		x		
Emma, 14	x	x			x		x	x					x			x		x		x		x	x	x	x	x	x	x		
Georgia	x	x			x		x	x			x			x			x	x	x	x	x		x			x		x	
Peter, 11	x	x			x		x	x					x		x			x		x	x		x			x		x	
Arthur, 14	x	x			x		x	x			x			x									x	x	x		x	x	
Jacob, 13	x	x	x		x		x	x					x			x		x		x		x	x	x	x	x				x
Martin, 13	x	x	x		x		x	x					x			x		x		x	x		x	x	x	x		x		
Jon, 10	x	x	x		x		x	x					x			x		x		x		x	x	x	x	x		x		
Morris, 11	x	x			x		x	x					x		x			x		x	x		x			x		x		
Alice, 11	x	x			x		x	x				x		x			x		x				x	x		x		x		
Mary, 12	x	x	x		x		x	x			x			x			x		x				x			x		x		
Dorinda, 11	x	x			x			x				x						x		x			x			x		x		
Aaron, 11	x	x			x		x	x			x			x			x		x			x	x	x		x		x		
Frank, 12	x	x			x		x	x			x			x				x		x	x		x	x	x		x		x	
Max, 9	x	x			x		x	x			x		x	x	x			x		x			x	x	x	x				
Harriet, 11	x	x			x			x					x		x			x		x			x	x		x		x		
Drake, 9	x	x		x					x		x			x			x		x			x	x							
Carol, 7	x	x			x		x				x			x			x	x	x	x	x		x					x		

*x = demonstrated ability, as scored in Table II, page 61.
affirmative response

TABLE XVI: RESULTS OF FIRST TERM POST-TEST FOR COGNITIVE SKILLS
January 1973

CONTROL GROUP	CONSERVING										GROUPING										SEQUENTIAL ORDERING									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Dotty, 15	x	x			x		x						x		x			x		x		x	x	x				x		
Emma, 14	x	x			x		x						x		x			x		x		x	x	x	x			x		
Georgia, 13	x				x		x					x		x			x	x	x	x		x	x	x	x			x		
Peter, 11	x				x		x						x		x			x		x		x	x					x		
Arthur, 14	x	x			x		x						x		x			x		x			x	x	x					
Jacob, 13	x	x			x		x						x			x		x		x		x	x	x	x			x		
Martin, 13	x	x			x		x						x		x			x		x		x	x					x	x	
Jon, 10	x	x	x		x		x						x		x			x		x		x	x	x	x			x		
Morris, 11	x				x		x						x		x			x		x		x	x	x				x	x	
Alice, 11	x	x			x		x						x		x			x		x			x	x		x				
Mary, 12	x				x		x				x			x			x		x			x	x				x			
Dorinda, 11	x	x			x		x						x			x		x		x		x	x	x				x		
Aaron, 11	x				x		x					x		x			x	x	x	x		x	x	x				x		
Frank, 12	x	x			x		x					x		x			x	x	x			x	x	x	x			x		
Max,9	x	x			x		x						x			x		x					x	x	x			x		
Harriet, 11	x	x			x		x						x		x			x		x			x	x	x		x			
Drake, 9	x				x		x					x		x			x	x	x	x		x	x				x			
Carol, 7	x	x			x		x				x			x			x		x				x			x				

*x = ~~demonstrated ability~~, affirmative response, as scored in Table IV, page 63.

TABLE XVII: RESULTS OF ADDITIONS TO FIRST TERM POST-TEST OF COGNITIVE SKILLS
January 1973

EXPERIMENTAL GROUP	CLAY		HORIZONTALITY					VERTICALITY					ORDERING			OVERLAP		
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Daisy		x					x			x					x			x
Sue	x						x					x			x			x
Carol	x						x				x				x			x
Tom		x				x						x			x			x
Burt		x					x					x			x			x
Dan		x				x						x			x			x
Don		x					x					x			x			x
Elmer		x					x		x			x			x			x
Eve	x			x								x			x			x
Betty		x			x						x				x			x
Jane	x						x			x		x			x			x
Ellen		x					x					x			x			x
Roy	x				x				x			x		x				x
Rick		x					x					x			x			x
Reuben		x				x						x			x			x
Victor	x						x				x				x			x
David	x						x					x						x
Ruth	x		x							x			x					x

CONTROL GROUP	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Dotty		x					x				x				x			x
Emma	x			x					x						x			x
Georgia	x			x				x			x				x			x
Peter	x						x					x	x					
Arthur	x				x				x	x								x
Jacob	x						x					x			x			x
Martin	x								x						x			x
John		x					x		x			x			x			x
Morris	x						x				x	x			x			x
Alice	x			x					x						x			x
Mary	x		x						x									
Dorinda	x			x	x				x	x					x			x
Aaron	x			x						x					x			x
Frank	x						x					x			x			x
Max	x									x					x		x	
Harriet				x							x				x		x	
Drake											x				x			x
Carol				x							x						x	

* x= ~~demonstrated ability~~ affirmative response, as scored in Table IV, Page 64.

TABLE XVIII: HORIZONTAL ORIENTATION

Scored on the basis of 1 to 5 points as follows:
1 - represents water with scribble (Stage I)
2 - " " " line parallel to the base of bottle (IIA)
3 - " " " sharply oblique line in tilted bottle, others horiz. (IIB)
4 - " " " slightly oblique line " " " " " (IIIA)
5 - " " " horizontal line in all bottles (IIIB)

Experimental Group	pre-test Dec,1972	post-test Dec,1972	post-test Jan,1973	Control Group	pre-test Jan,1973
Daisy 13 E-R	3	4	5	Dotty 15 E-R	5
Sue 13 E-R	3	4	5	Emma 14 E-R	2
Carol 14 R	4	5	5	Georgia 13 R-E	2
Tom 14 E-R	3	4	4	Peter 11 E-R	5
Burt 13 E-R	3	4	5	Arthur 14 E-R	3
Don 15 E	4	4	5	Jacob 13 E	5
Dan 15 E	3	5	4	Martin 13 E	2
Elmer 12 E	3	4	5	John 10 E	5
				Morris 11 E	5
Eve 13 E-R	2	4	2		
Betty 12 R	4	4	3	Alice 11 E-R	2
Jane 11 E-R	3	3	5	Mary 12 E	1
Ellen 12 E-R	5	5	5	Dorinda 11 R-E	2
Roy 12 E	1-2	3	3	Aaron 11 E	2
Richard 12 E-R	5	5	5	Frank 12 E	5
Ruben 11 R	5	5	3	Morry 9 E	2
				Harriet 11 E-R	2
Victor 8 R	3	3	5		
David 9E-R	3	4	5	Drake 9 E	2
Ruth 9 E-R	1	1	1	Carol 7 E	2
	av. 3.27		4.16		3.00

TABLR XIX: VERTICAL ORIENTATION

Scored on the basis of 1 to 5 points as follows:

1 - draws house inside or parallel to mountain (I)
2 - " " perpendicular to mountain (IIA)
3 - " " somewhere between perpendicular and vertical
4 - " " vertical but without apparent support
5 - " " vertical with apparent support (III)

Experimental Group		Pre-test Dec.1972	Post-test Dec.1972	Post-test January 1973	Control Group	Post-test Jan.1973
Daisy	13 E-R	2	2	3	Dotty	4
Sue	13 E-R	3	4	5	Emma	2
Carol	14 R	3	3	4	Georgia	1
Tom	14 E-R	5	5	5	Peter	5
Burt	13 E-R	5	5	5	Arthur	2
Don	15 E	*	4	5	Jacob	5
Dan	15 E	2	5	5	Martin	2
Elmer	12 E	4	**	5	John	2
					Morris	4
Eve	13 E-R	2	2	5	Alice	2
Betty	12 R	3	4	4	Mary	2
Jane	11 E-R	3	3	5	Dorinda	2
Ellen	12 E-R	5	5	5		
Roy	12 E	5	4	2	Aaron	3
Richard	12 E-R	5	5	5	Frank	5
Ruben	11 R	2	5	5	Morry	4
					Narriet	4
Victor	8 R	3	3	4	Drake	4
David	9 E-R	2	5	5	Carol	4
Ruth	9 E-R	2	2	3		
		av. 3.29	3.88	4.44		3.16

* solved problem by filling up the valley with land under the house
** solved problem by showkng boy falling down slope calling "help"

TABLE XX: Pre-test Results of Ability to Select, Combine, and Represent

	SELECTING 1 2 3 4 5	COMBINING 1 2 3 4 5	REPRESENTING 1 2 3 4 5	LANGUAGE* 1 2 3 4 5
Daisy	3	3	3	3 (sol-or)
Sue	1	1	1	None
Carol	5	3	5	5 (sp-W)
Tom	5	5	3	2 (sol-o)
Burt	1	1	1	None
Eve	5	5	4	3 (sp-o)
Betty	1	1	1	None
Jane	2	3	1	2 (sp-w)
Ellen	5	5	5	5 (sp-w)
Roy	1	1	3	None
Richard	5	5	5	None
Ruben	3	1	3	3 (sp-w)
David	3	3	5	5 (sol-o)
Ruth	2	4	2	None
Elmer	3	3	4	3 (sp-w)
Dan	1	3	2	3 (sp-w)
Don	3	4	4	1 (sp-w)
Victor	5	5	5	1 (sp-w)

*sol - solicited
sp - spontaneous
w - written
o - oral

TABLE XXI: Post-test Results of Ability to

Select, Combine, Represent

x = demonstrated ability, as scored in Table V, page 65.

EXPERIMENTAL GROUP

	SELECTION					COMBINATION					REPRESENTATION					LANGUAGE*					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Daisy					x					x				x							
Sue					x					x					x						
Carol			x							x					x						
Tom					x					x					x						
Burt					x					x					x		x				(o)
Don					x					x				x							
Dan					x			x						x						x	(sp-w)
Elmer					x					x					x					x	(sp-w)
Eve					x					x					x						
Betty					x			x						x							
Jane					x			x							x		x				(o)
Ellen					x					x				x							
Roy	x					x									x						
Richard					x			x						x							
Ruben					x					x					x					x	(sp-w)
David					x			x						x							
Ruth	x								x					x			x				(sol-o)
Victor					x					x					x						
CONTROL GROUP																					
Dotty			x			x					x										
Emma					x					x					x		x				(o)
Georgia					x			x						x							
Peter			x					x						x					x		(sp-w)
Arthur	x					x					x										
Jacob					x					x					x		x				(o)
Martin		x						x			x										
John					x					x					x				x		(sp-w)
Morris	x					x								x							
Alice					x					x					x				x		(o)
Mary					x	x								x			x				(sp-w)
Dorinda					x			x						x							
Harriet	x					x					x										
Aaron		x				x								x					x		(sp-w)
Frank		x				x					x										
Morry	x					x								x			x		x		(w-o)
Drake	x					x								x							
Carol		x				x					x										

TABLE XXII: Results: Evaluation of Art Work

by Professor of Art and Education

			SELECTING A	COMBINING B	LANGUAGE C	REPRESENTING D	ATTITUDES E	SENSITIVITY & SKILLS F
33	Daisy	1	1	5	3	3	1	1
56		2	4	5	3	3	0	2
50		3	1	5	0	2	0	2
51	Sue	1	4	5	3	3	4	2
49		2	3		3	3	3	2
26		3	1	5	0	1	0	1
52	Carol	1	1	4	0	1	0	1
24		2	5	5	3	5	3	2
60		3	1	5	0	5	0	5
16	Burt	1	1	1	0	1	4	1
36		2	5	5	3	3	0	2
18		3	1	5	3	5	2	2
28	Tom	1	1	1	0	1	1	2
54		2						
42		3	5	5	3	3	0	2
34	Dan	1	5	5	3	3	0	1
15		2	5	4	0	3	0	2
9		3	5	5	0	1	0	3
1	Don	1	1	1	3	1	1,3	1
27		2	3		3	3	0	2
38		3	5	5	3	3	0	1
12	Elmer	1	1	3	0	1	0	1
53		2	3	5	3	5	0	
59		3	3	4	3	3	0	1
47	Eve	1	5	5	3	3	3	3
11		2	3	5	1	2	0	2
19		3	5	5	0	4	6	4
57	Betty	1	1	1	1	1	1	1
5		2	5	5	0	3	6	5
46		3	5	5	0	3	0	4
48	Jane	1	3	4	3	2	3	
44		2	1	4	0	1	0	2
14		3	1	5	0	2	0	1

Cont'd

XXII:
(cont'd)

EVALUATION OF ART WORK BY A PROFESSOR OF ART EDUCATION

			SELECTING A	COMBINING B	LANGUAGE C	REPRESENTING D	ATTITUDES E	SENSITIVITY & SKILLS F
32	Ellen	1	5	5	3	4	0	1
8		2	5	5	0	4	3	4
55		3	2	5	0	2	0	2
3	Roy	1	1	4	0	1	0	1
23		2	5	5	3	5	2	3
30		3	5	5	0	4	4	5
39	Rick	1	5	5	0	4	0	5
2		2	1	5	1	3	3	3
4		3	5	5	0	5	6	5
22	Ruben	1						
29		2	5	5	3	3	0	1
20		3	3	5	3	3	0	2
41	David	1	1	4	0	3	0	3
58		2	1	3	0	2	1	2
7		3	5	5	3	3	6	5
45	Ruth	1	1	1	0	1	1	1
37		2	5	5	5	5	4	3
17		3	5	5	5	5	6	5
31	Victor	1	1	1	0	1	1	1
67		2	1	3	1	2	1	1
6		3	5	5	0	5	6	5

Table XXIII: Results, Teacher Rating Scale, Pre-Test Experimental Group

EXPERIMENTAL GROUP			LANGUAGE DEVELOPMENT										COGNITIVE ABILITY										ATTITUDINAL CHANGE									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Daisy	13	E-R		4	3	3	4	3	3	3	3	2	3	3	3	3	3	2	2	2	3	3	3	2	3	4		3	2	2	3	4
Sue,	13	E-R	3	4	4	3	3	4	4	4	3	3	3	3	3	3	4	4	4	3	3	3	4	4	3	4		4	3	3	3	3
Carol	14	R	4	4	4	4	4	4	3	4	4	3	4	3	3	3	3	4	3	3	3	3	4	4	3	4		4	3	3	4	4
Tom	14	E-R	4	3	4	4	4	3	2	3	4	2	4		4	2	3	5	5	3	2	2	3	2	2	2		3	4	4	1	4
Burt	13	E-R	1	4	4	4	2	1	3	4	4	2	3	1	3	1	1	3	3	1	5	1	1	2	4	4		3	4	4	5	3
Don	15	E	4	4	4	4	4	3	3	3	3	2	3	3	3	3	3	5	4	3	3	3	4	5	4	4		5	5	5	5	4
Dan	15	E	4	4	4	4	4	4	3	4	2	2	4	3	3	3	4	5	5	3	3	4	5	5	4	4		5	5	5	5	4
Elmer	12	E	4	4	4	4	4	4	4	4	4	3	4	3	3	3	4	4	4	3	3	4	4	4	4	3		3	5	5	5	3
Eve	13	E-R	5	4	3	4	4	3	2	3	3	3	4	3	3	2	2	3	2	1	3	2	4	2	2	2		5	5	5	5	4
Betty	12	R	4	3	3	3	3	2	1	2	2	1	4	3	3	3	2	3	3	3	4	1	3	2	2	5		4	4	4	5	3
Jane	11	E-R	4	3	3	4	3	2	1	2	3	1	4	3	3	2	2	3	4	3	4	1	4	4	4	4		4	5	5	4	4
Ellen	12	E-R	4	4	4	4	4	4	3	4	4	2	5	4	4	3	3	4	4	4	4	3	5	5	5	5		5	5	5	5	4
Roy	12	E	5	4	3	4	2	3	2	4		1	4		3		3	4	3	2	4	4	3	4	2	2		3	4	3	3	2
Richard	12	E-R	4	3	3	3	2	2	2	3	3	3	4	4	4		4	3	3	3	4	5	3	4	4	4		3	3	3	4	4
Ruben	11	R	4	4	4	5	4	5	3	3	4	2	3	2	4	5	3	4	4	4	4	4	4	4	4	4		4	4	4	4	4
Victor	8	R	5	5	5	4	1	4	3	4	3	1	4	3	4	1	3	5	5	5	1	4	5	4	4	5		5	5	5	4	4
David	9	E-R	5	5	5	5	3	5	5	5	5	2	5	3	3	1	4	5	5	5	1	2	5	2	2	5		3	5	5	2	2
Ruth	9	E-R	3	3	3	3	1	4	3	3	3	1	2	1	1	1	1	3	3	3	1	1	3	2	2	5		4	4	4	5	2

Table XXIV: Results, Teacher Rating Scale, Post-test, Experimental Group

EXPERIMENTAL GROUP			Language Development										Cognitive Ability										Attitudinal Change									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Daisy	13	E-R	3	3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	3	3	3	2	3	3	3	3		3	2	2	3	3
Sue,	13	E-R	4	4	4	4	4	4	3	4	3	3	4	3	4	3	3	3	3	3	3	3	4	3	3	4		3	3	3	3	3
Carol	14	R	4	4	4	4	4	3	3	4	4	3	3	3	3	3	3	4	3	3	3	3	4	4	3	4		4	4	4	4	3
Tom	14	E-R	3	3	3	3	2	3	3	4	4	2	4	4	4	4	2	4	3	3	4	5	4	3	4	3		4	4	3	2	4
Burt	13	E-R	4	4	4	1	1	1	1	3	2	2	3	2	3	3	4	3	1	1	4	2	/	/	2	5		3	2	2	2	2
Don	15	E	4	3	3	3	4	4	3	3	3	3	3	3	3	3	3	4	3	3	1	2	3	4	4	4		5	4	4	4	5
Dan	15	E	4	4	4	4	4	4	4	4	4	3	4	4	4	3	4	5	4	3	1	1	4	4	4	3		3	5	5	5	4
Elmer	12	E	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	5	5	4	1	2	5	4	4	3		3	5	5	4	4
Eve	13	E-R	5	5	4	5	5	4	4	5	5	1	5	5	4	4	3	5	4	3	3	3	5	5	5	3		5	5	5	5	5
Betty	12	R	4	4	4	4	3	3	3	3	3	3	5	3	3	4	3	3	4	4	5	3	4	3	3	4		4	4	4	4	3
Jane	11	E-R	4	5	5	5	3	4	3	4	4	3	5	3	3	3	4	5	5	4	5	3	4	5	5	5		5	5	5	5	5
Ellen	12	E-R	5	5	5	5	4	4	3	4	4	3	5	5	5	4	4	5	4	5	4	4	5	5	5	5		5	5	5	5	5
Roy	12	E	3	3	2	3	2	1	1	1	1	1	3	2	2	1	2	4	3	1	4		3	3	3	2		2	2	2	2	3
Richard	12	E-R	4	3	3	3	3	3	2	3	3	1	4	4	4	4	4	3	3	3	3	4	3	4	4	4		3	2	3	4	4
Ruben	11	R	4	4	4	4	4	4	3	3	3	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4
Victor	8	R	4	4	5	4	3	3	2	3	3	1	4	3	3	2	2	5	5	2	1	1	4	3	3	5		5	5	5	3	3
David	9	E-R	5	5	5	5	3	4	4	4	2	1	4	3	2	1	2	5	5	3	1	1	4	1	1	4		4	5	5	2	3
Ruth	9	E-R	3	3	3	3	2	2	1	2	2	1	2	1	2	1	1	4	3	1	1	1	3	5	5	5		5	5	5	5	2

Table XXV: Results, Teacher Rating Scale, Pre-test, Control Group

CONTROL GROUP			Language Development										Cognitive Ability										Attitudinal Change									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Dotty	15	E-B	2	3	3	2	2	1	2	1	3	1	3	3	3	3	3	3	3	2	2	2	3	3	3	3		3	3	3	3	2
Emma	14	E-B	4	4	4	4	4	4	3	4	4	3	4	3	4	3	3	4	3	3	3	3	4	4	3	4		4	3	3	3	3
Georgia	13	B-E	3	4	4	3	4	3	3	3	3	3	3	3	3	3	4	3	3	3	3	2	3	3	3	4		3	3	3	4	3
Peter	11	E-B	3	3	3	4	3	3	3	3	4	2	3	2	3	3	3	4	3	2	3	2	3	4	4	4		4	3	3	5	3
Arthur	14	E-B	3	2	1	3	3	2	1	1	1	1	2	1	1	1	2	4	3	2	4	1	4	4	4	2		3	4	4	3	4
Jacob	13	E	4	4	4	4	4	3	3	4	3	3	3	3	3	3	4	5	4	3	3	3	4	5	4	4		4	5	5	4	3
Martin	13	E	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	3	4	4	5		5	5	5	4	3
John	10	E	4	4	4	4	4	4	3	4	4	3	4	3	3	3	4	5	4	3	3	4	4	5	4	3		3	5	5	5	4
Morris	11	E	4	4	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		3	4	4	3	3
Alice	11	E-B	5	5	5	1	5	5	5	4	4	4	3	3	3	2	3	2	2	1	5	1	2	4	3	5		5	3	3	5	5
Mary	12	E	5	4	4	4	4	4	4	3	3	2	4	2	2	2	2	3	3	2	4	1	5	3	3	1		5	5	5	2	2
Dorinda	11	B-E	4	3	3	3	2	1	1	2	1	1	4	3	3	2	2	4	3	2	4	1	2	2	2	3		4	2	2	3	3
Aaron	11	E	4	5	5	3	3	2	1	1	1	1	3	3	3	3	2	4	4	3	2	2	4	4	4	4		4	4	4	4	4
Frank	12	E	4	4	4	4	3	3	3	3	3	2	3	3	3	2	3	4	3	2	2	2	3	2	2	2		2	3	3	3	2
Morry	9	E	4	4	4	4	4	4	4	3	4	3	3	3	3	4		2	4	3	2	2	4	3	3	4		4	4	4	4	3
Harriet	11	E-B	3	2	2	3	2	3	2	3	3	2	3	2	2	2	2	3	3	3	2	2	3	4	4	3		4	3	3	3	2
Drake	9	E	3	4	3	3	1	3	3	3	2	1	2	2	1	1	2	3	2	2	1	1	3	4	4	5		4	4	4	4	3
Carol	7	E	5	5	5	5	1	5	3	3	2	1	3	3	3	1	2	4	3	2	1	3	3	3	3	5		4	4	4	3	3

Table XXVI: Results, Teacher Rating Scale, Post-test, Control Group

CONTROL GROUP			Language Development										Cognitive Ability										Attitudinal Change									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Dotty	15	E-R	3	3	3	2	2	2	2	2	2	2	3	3	3	2	2	3	3	2	3	2	3	4	3	3		3	3	3	3	3
Emma	14	E-R	5	5	4	4	4	3	4	4	4	3	4	4	4	3	3	3	3	3	3	3	4	4	3	4		4	3	3	3	3
Georgia	13	R-E	3	3	3	3	4	3	4	3	3	3	4	3	3	3	3	3	3	3	3	3	3	4	3	3		3	3	3	3	3
Peter	11	E-R	3	3	3	3	3	4	3	4	4	3	3	4	4	4	4	4	4	3	4	3	4	5	5	5		5	4	4	4	4
Arthur	14	E-R	4	4	4	4	3	3	3	3	3	2	3	3	4	4	4	5	4	4	4	2	4	5	5	2		3	4	4	4	2
Jacob	13	E	4	4	4	4	4	4	3	4	4	3	3	3	3	3	3	4	3	3	1	3	3	4	5	4		5	5	5	5	5
Martin	13	E	3	3	3	3	3	3	2	2	3	1	3	3	3	2	3	3	3	2	1	1	3	4	4	4		4	3	3	3	3
John	10	E	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	5	5	3	1	1	4	4	4	3		3	5	5	3	5
Morris	11	E	4	3	2	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	3		3	3	3	3	2
Alice	11	E-R	4	5	4	2	4	4	4	4	4	4	4	3	2	2	3	3	2	3	4	3	2	4	4	5		5	4	4	3	4
Mary	12	E	4	5	4	4	3	4	3	1	1	1	4	3	3	3	3	5	3	1	1	1	3	3	3	1		1	3	3	2	1
Dorinda	11	E-E	3	4	3	4	3	3	3	3	3	2	4	3	3	3	3	4	4	2	4	3	3	4	3	5		5	4	4	5	4
Aaron	11	E	4	4	4	4	3	3	2	2	2	2	3	3	3	3	3	4	3	2	1	1	4	4	4	4		4	3	3	4	4
Frank	12	E	4	4	4	4	4	4	4	3	4	1	4	4	4	4	4	4	4	2	4	4	3	2	2	2		2	3	2	3	3
Morry	9	E	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4		4	4	4	4	4
Harriet	11	E-E	2	2	2	2	2	2	2	2	1	1	3	2	2	2	3	3	3	1	3	1	3	4	4	4		4	4	4	3	3
Drake	9	E	3	3	3	3	1	2	1	1	1	1	2	2	2	1	1	3	3	1	1	1	3	5	5	5		5	5	5	4	3
Carol	7	E	4	4	3	4	1	3	2	2	1	1	3	2	2	1	1	4	3	1	1	1	2	2	2	5		5	5	5	2	3

XXVII: Results, Torrance Test of Creative Thinking, Pre-post Experimental Gro: p

	FIGURAL FORM A Pre-test (Oct., 1972) T-Score				FIGURAL FORM B Post-test (Jan., 1973)			
EXPERIMENTAL GROUP	Flu.	Flex.	Org.	Elab.	Flu.	Flex.	Org.	Elab.
Daisy	54	60	67	64	55	57	49	49
Sue	47	48	58	45	52	54	43	43
Carol	57	54	80	61	52	59	47	54
Tom	42	45	41	65	57	57	69	57
Burt	54	54	84	53	44	40	52	41
Don	47	57	52	46	54	57	49	45
Dan	55	48	41	54	48	45	38	46
Elmer	40	50	39	43	42	48	33	39
Eve	30	35	43	100+	52	40	50	100
Betty	30	37	37	40	52	50	40	44
Jane	35	40	40	58	55	63	50	49
Ellen	44	50	44	59	52	59	50	47
Roy	30	33	42	63	34	39	44	42
Richard	28	35	35	72	67	50	50	71
Ruben	29	37	32	32	54	40	29	50
Victor	47	50	62	46	55	39	33	50
David	28	33	38	50	38	44	45	51
Ruth	24	25	32	31	29	30	39	39

XXVIII: Results, Torrance Test of Creative Thinking, Pre-post Control Group

	FIGURAL FORM A Pre-test (Oct.,1972) T Score				FIGURAL FORM B Post-test (Jan., 1973			
CONTROL GROUP	Flu.	Flex.	Org.	Elab.	Flu.	Flex.	Org.	Elab.
Dotty	30	33	35	43	45	42	37	48
Emma	47	52	56	52	48	52	38	49
Georgia	42	45	50	47	54	57	42	47
Peter	39	40	38	56	40	39	49	53
Arthur	48	48	44	83	48	50	52	39
Jacob	34	37	37	56	39	35	40	52
Martin	38	48	43	36	55	54	62	36
John	44	52	53	42	48	52	70	42
Morris	44	42	37	31	72	69	54	43
Alice	45	45	57	64	38	40	72	43
Mary	50	39	62	44	39	35	53	28
Dorinda	52	59	59	60	58	52	44	44
Aaron	34	40	40	26	58	44	41	30
Frank	28	35	33	49	57	54	52	65
Morry	57	57	77	39	45	50	40	34
Harriet	30	30	32	49	42	48	37	35
Drake	27	27	0	37	37	42	45	34
Carol	39	42	42	26	52	40	40	41

XXIX: Results, Evaluation of Art Work by an Art Therapist-Painter

			REPRESENTATION	ATTITUDES	SENSITIVITY and SKILL
33	Daisy	1	2	4	1
56		2	1	0	1
50		3	1	0	1
51	Sue	1	3	3	1
49		2	1	2	1
26		3	1	0	1
52	Carol	1	3	0	3
24		2	4	0	3
60		3	5	0	5
54	Tom	1	4	0	4
28		2	4	1 2 4 6	5
42		3	5	6	5
16	Burt	1	1	1 2 4	1
36		2	3	2 4 6	2
18		3	5	1 2 4 6	5
34	Don	1	5	3 4 6	3
15		2	2	0	3
9		3	5	6	5
1	Dan	1	1	0	1
27		2	1	0	1
38		3	3	6	3
12	Elmer	1	1	0	1
53		2	1	0	1
59		3	1	0	2
57	Betty	1	2	0	1
5		2	5	0	5
46		3	5	5	5

			REPRESENTATION	ATTITUDES	SENSITIVITY and SKILL
47	Eve	1	2	0	2
11		2	1	0	3
19		3	2	0	1
48	Jane	1	1	0	2
44		2	1	0	1
14		3	2	0	1
32	Ellen	1	3	0	3
8		2	4	0	3
55		3	1	0	2
3	Roy	1	2	0	1
23		2	5	3 4 6	5
30		3	5	4 6	5
39	Rich.	1	5	2	5
2		2	4	2	3
4		3	5	2 3 6	5
22	Ruben	1	1	0	1
29		2	5	0	3
20		3	4	0	5
41	David	1	5	3	5
58		2	5	0	5
7		3	5	6	5
45	Ruth	1	1	0	1
37		2	5	3 6	5
17		3	5	6	5
31	Victor	1	1	0	1
61		2	1	0	1
6		3	5	6	5

TABLE XXX: RESULTS: PRE-POST CLASSROOM TEST OF ABILITY TO REPRESENT SPATIAL RELATIONSHIPS

Scored on a basis of 1 to 4 points for number of correct representations of the following relationships:

	Above-Below Horizon or base plane	Left Right	Front Back	Distance	Proportion	Total (of a possible 20)
Jane 11						
#1	4	4	4	4	4	20-100%
#2	4	4	4	4	4	20-100%
#3[1]	4	4	4	4	4	20-100%
Sue 13 E-R						
#1	4	4	4	4	4	20-100%
#2	4	4	4	4	4	20-100%
#3[3]	3	3	3	2	3	14- 93%
#4[1]	4	4	4	4	4	20-100%
Daisy 13 E-R						
#1	4	4	0	4	3	15- 75%
#2	4	4	0	4	3	15- 75%
#3	4	4	3	4	3½	18½-93%
#4	4	4	4	4	3	19- 95%
#5[3]	3	3	3	3	3	15-100%
Ellen 12						
#1	4	-	3	4	3	14- 70%
#2[3]	3	3	3	3	3	15-100%
#3	4	4	4	4	4	20-100%
Eve 13 E-R						
#1	4	-	4	4	4	20-100%
#2	4	3	3	4	4	
#3[2]	4	4	4	4	4	20-100%
#4	4	4	4	4	4	20-100%
Betty 12R						
#1	4	4	0	4	3	15- 75%
#2[3]	4	4	0	4	4	14- 70%
#3	2	3	3	3	3	14- 70%
Tom 14 E-R						
#1	4	4	4	4	4	20-100%
#2	4	4	4	4	4	20-100%
#3[1]	4	4	4	4	4	20-100%
Burt 13 E-R						
1	4	0	0	2	4	10- 50%

Cont'd

Cont'd

	Above-Below Horizon or base plane	Left Right	Front Back	Distance	Proportion	Total(of a possible 20)
#2	32	0	3	3	3	12- 80%
#3	32	3	3	2	2	13- 87%
#4	1	3	2	2	2	10- 50%
David 9						
#1	4	0	0	0	4	8- 40%
#2	32	0	3	3	3	12- 80%
#3	4	4	4	4	4	20-100%
#4	4	4	4	4	4	20-100%
Carol 14 R						
#1	4	4	3	2	2	15- 75%
#2	4	4	0	2	4	14- 70%
#3	4	0	0	0	4	8- 40%
Ruben 11 R						
#1	3		0	0	2	5- 25%
#2	3*		0	0	0	3- 15%
#3	4	4	3	4	3	18- 90%
#4	2	2	0	2	2	8- 40%
#5	3		0	0	0	3- 15%
#6	3		0	0	2	5- 25%
Roy 12 E						
#1	4		4	4	4	16- 80%
#2	3*		0	0	0	9- 45%
#3	4	4	4	4	4	20-100
#4						
#5	2/2	4	2/2	2/2	2/2	
Rick 12 E-R						
#1	4		3	3	4	14- 70%
#2	4	4	3	4	3	18- 90%
#3	4	4	4	4	4	20-100%
#4	4	4	4	4	4	20-100%
#5	4	4	4	4	4	20-100%
Don 14R						
#1	4		2	2	4	12- 60%
#2	4		3	4	4	15- 75%
#3	4	4	2/2	4	4	
#4	4	4	4	4	4	20-100%
#5	4	4	4	4	4	20-100%
Dan 15 E						
#1	4	4	0	2	3	13- 65%
#2	4	4	2	4	4	18- 90%
#3	4	3	2	4	4	17- 85%
#4	plane	4	4	4	4	20-100%
#5	plane	4	4	4	4	20-100%
#6	plane	4	4	4	4	20-100%

Cont'd

Cont'd

	Above-Below Horizon or base plane	Left Right	Front Back	Distance	Proportion	Total(of a possible 20)
Elmer 12 @						
#1	4	4	0	2	2	12- 60%
#2	3	3	3	4	3	16- 80%
#3	4	4	3	4	4	19- 95%
#4[1]	plane	2	3	3	2	14- 70%
#5[1]	plane	4	4	4	4	20-100%
#6	4	4	4	4	4	20-100%

---

[1]Reversal of preceding number

[2]Omitted bug. Scoring consequently based on 3 rather than 4 objects

[3]Bug hidden from view

Table XXXI: RESULTS OF SECOND TEACHER RATING SCALE SHOWING GAINS BETWEEN SEPTEMBER, 1972, AND MAY, 1973

EXPERIMENTAL GROUP	TOTAL GAIN	MATHEMATICS Sept.	May		READING Sept.	May		LANGUAGE Sept.	May		ATTITUDES Sept.	May		MOTOR OR VISUO-SPATIAL Sept.	May	
Daisy	1	2	3	+1	3	3	+0	3	3	+0	2	2	+0	4	4	+0
Sue	2	3	4	1	3	3	0	5	5	0	3	4	1	5	5	0
Carol	1	3	4	1	3	3	0	5	5	0	4	4	0	5	5	0
Tom	9	2	3	1	2	3	1	1	3	2	1	3	2	1	4	3
Burt	15	1	4	3	0	3	3	1	3	2	1	4	3	1	5	4
Dan	4	3	4	1	3	4	1	3	4	1	5	5	0	4	5	1
Don	4	4	5	1	4	5	1	3	4	1	5	5	0	4	5	1
Elmer	4	4	5	1	5	5	0	4	5	1	5	5	0	3	5	2
Eve	2½	2	3	1	3	3½	½	3	4	1	5	5	0	5	5	0
Betty	6	2	4	2	3	4	1	2	3	1	2	4	2	5	5	0
Jane	6	2	4	2	2	4	2	2	4	2	3	3	0	5	5	0
Ellen	1½	4	4½	½	4	4½	½	4	4½	½	5	5	0	5	5	0
Roy	3	1	1	0	2	3	1	2	3	1	3	2	-1	2	3	1
Rick	3½	3	4	1	2	2½	½	3	4	1	3	4	1	3	3	0
Reuben	3	3	3	0	3	4	1	3	4	1	3	4	1	3	3	0
Victor	4	3	4	1	2	3	1	4	4	0	3	4	1	3	4	1
David	6	3	4	1	3	4	1	5	5	0	2	4	2	3	5	2
Ruth	6	2	3	1	2	3	1	1	2	1	3	4	1	1	3	2
	81.5			19.5			15.5			15.5			13			17
CONTROL GROUP																
Dotty	2	2	3	+1	1	2	+1	1	1	+0	4	4	+0	3	3	+0
Emma	2	4	5	1	3	4	1	5	5	0	3	3	0	5	5	0
Georgia	2	4	5	1	3	4	1	5	5	0	3	3	0	5	5	0
Arthur	9	2	4	2	2	3	1	1	3	2	1	3	2	2	4	2
Peter	7	2	4	2	2	3	1	2	3	1	2	3	1	3	5	2
Jacob	5	4	5	1	3	5	2	3	5	2	5	5	0	5	5	0
Martin	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3	0
Morris	6	1	3	2	1	3	2	5	5	0	3	5	2	4	4	0
Harriet	3	2	3	1	2	3	1	2	3	1	3	3	0	3	3	0
Mary	1	1	1	0	3	3½	1/2	3	3½	1/2	2	2	0	2	2	0
Alice	0	1	1	0	1	1	0	3	3	0	2	2	0	3	3	0
Dorenda	3½	1	2	1	2	2½	1/2	2	3	1	2	3	1	4	4	0
Arron	2	2	3	1	3	3	0	3	3	0	4	4	0	2	3	1
Frank	1	2	2	0	3	3	0	3	3	0	Inconsistent			2	3	1
Max	3	3	4	1	4	5	1	4	5	1	3	3	0	3	3	0
Drake	2	3	4	1	1	2	1	3	3	0	4	4	0	2	2	0
John*	2	5	5	0	4	4	0	4	5	1	4	4	0	4	5	1
Carol	3	2	3	1	2	3	1	4	4	0	3	4	1	2	2	0
	53.5			16			14			9.5			7			7

Rated on basis of 1 to 5 point with 1 indicating very little skill, 3 indicating moderate skill, and 5 indicating much skill.

* Since John was integrated into a regular school in January, he was rated for January, 1973, instead of May, 1973.

STATISTICAL ANALYSIS OF TEST OF COGNITION BASED ON PIAGETIAN PRINCIPLES OF CONSERVATION, GROUPING AND SERIATION; AND TEST OF ABILITY TO SELECT, COMBINE AND REPRESENT.

Analysis performed by John L. Kleinhans, Ph.D.
Assistant Professor of Psychology
Manhattanville College, Purchase, New York

The raw data for the first term post test of cognition was broken down into fourteen key items.* A positive response (marked by an x in the data tables) constituted one score point. Thus, an individual student's composite score is simply the total number of positive responses on the key items; the potential range is 0 to 14. The composite scores cannot be assumed to form an interval scale, therefore distribution-free (non-parametric) descriptive and inferential methods are appropriate to this data. A median test generating a chi square statistic was used to evaluate the significance of any difference between control and experimental groups.

Descriptive summary statistics:

The median score for experimental and control groups combined was 9.37. The median of the experimental group was 11.75, and of the control group, 8.5. Of the 18 experimental students, 14 had scores exceeding the combined median and 4 fell below. Of the 18 control students, 3 were above, and 15 below the combined median. The chi square value derived from the resulting 2 X 2 contingency table was 11.15. With one degree of freedom, the observed chi square exceeds the criterion value of 10.83 required for the rejection of the null hypothesis of no difference between groups at the .001 level of confidence. Thus the observed difference between groups in favor of the experimental group, is shown to be highly significant.

---

*see Project Report, pages 63-64, Nos. 3 (conservation of liquid), 5 (conservation of number), 13 (grouping 3 objects), 18 (grouping from an array, 22 (ordering a series), 25 (transposing a matrix), 32 (conservation of clay), 37 (horizontal orientation), 42 (vertical orientation), 45 (ordering color cards), 48 (placing objects in given positions). Also, in ability to form groups, page 84, Selection (3-5), Combination (3-5), Representation (3-5).

Appendix: Data used in performing median test.

Score	Frequency (Exp.)	Frenquency (cont.)
1	0	0
2	0	1
3	0	0
4	0	1
5	2	2
6	0	2
7	0	2
8	0	1
9	2	6
10	3	1
11	1	0
12	4	1
13	5	0
14	1	1
	N = 18	N = 18

Combined Median = 9.37

	Exp.	Cont.
Above Comb. Med.	14	3
Below Comb. Med.	4	15

2. Test of ability to select, combine, and represent (first term)

Mean differences evaluated by t test.

I. Select: Experimental mean = 4.5; Control mean = 3.28;
t = 2.63, p less than .05 with df = 34 (two tailed test.)

II. Combine: Experimental mean = 4.17; Control mean = 2.33;
t = 3.78, p less than .01 with df = 34 (two tailed test).

III. Represent: Experimental mean = 4.11; Control mean = 2.78;
t = 3.08, p less than .01 with df = 34 (two tailed test).

In each of the three areas, subjects in the experimental group performed significantly better than controls.

3. Horizontal orientation; mean differences evaluated by t test.
Experimental group mean = 4.22; Control group mean = 3.19.
t = 2.19, p less than .05 with df = 34 (two tailed test).
Difference is significant.

4. Vertical orientation; mean differences evaluated by t test
Experimental group mean = 4.17; control group mean = 3.56.
t = 1.59, p greater than .05 with df = 34 (two tailed test).
Difference is not significant.

5. pre-post test of cognition, Fall Program (first term)

Pre and post test performances of the experimental group on the 6 critical items was evaluated by a sign test.

The improvement was significant at the .01 level (exact probability was less than .006). Controls had a net decline.

6. Ability to Select, Combine and Represent. Data from second term students. The data is analyzed twice; first, all data is analyzed by a t test; second, only data from Dr. Silver's groups are analyzed by t tests.

Ia. Select: all students. Experimental mean = 3.75, Control mean = 3.06. t = 1.92, p is greater than .05. Not significant.

Ib. Select: Dr. Silver's students. Experimental mean = 4.25, Control mean = 2.87. t = 2.29, p less than .05. Significant/

IIa. Combine: all students. Experimental mean = 3.06, Control mean = 2.44. t = 1.30. p is greater than .05. Not significant.

IIb. Combine: Dr. Silver's students. Experimental mean = 3.5, Control mean = 1.75. t = 2.82, p less than .05. Significant.

IIIa. Represent: all students. Experimental mean = 3.19, control mean = 2.38, t = 1.93, p is greater than .05. Not significant.

IIIb. Represent: Dr. Silver's students. Experimental mean = 3.5, Control mean = 2.0, t = 3.0, p is less than .01. Significant.

Re: A Study of Cognitive Skills Development Through Art Experiences, An Educational Program for Language and Hearing Impaired and Aphasic Children, Board of Education, City of New York

Rawley A. Silver, Ed.D., A.T.R.

State Urban Education Project No. 147232101, Function No.17-36413
1973

ADDENDUM

The footnotes on pages 76 through 80 whould be changed to read:

"X = responses, both correct and incorrect responses, as scored in Table II, page 61, or Table X, page 71".

The following sentence should be added to the last paragraph on page 22, "Both evaluations were made in May".